MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

VOL. XXVIII. DECEMBER, 1900. No. 12

INTRODUCTION.

The MONTHLY WEATHER REVIEW for December, 1900, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: regular stations of the Weather Bureau, 159; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Canadian Meteorological Service, 32; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Commander Chapman C. Todd, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Captain François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores, and W. M. Shaw, Esq., Secretary, Meteorological Office, London.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′ or $10^h\ 30^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

Exceptionally severe weather prevailed along the steamer routes of the Atlantic and Pacific oceans during December, 1900; and from the 20th until the close of the month disastrous storms visited the British Isles and the middle-western and northwestern coasts of continental Europe.

The most important storm of the month along the Atlantic coast of the United States appeared over the west Gulf States on the 3d, reached North Carolina by the morning of the 4th, passed thence, with a marked increase in intensity, to a position off the New England coast by the morning of the 5th, and disappeared east of Newfoundland during the 6th. Storm warnings were displayed from Hatteras, N. C., to Boston, Mass., the morning of the 4th, and the displays were extended to Eastport, Me., the afternoon of the 4th. On the morning of the 5th Atlantic coast ports from Norfolk, Va., to Portland, Me., were advised as follows:

Severe southerly gales will shift to northwest off Nova Scotia this afternoon and off Newfoundland to-night. Hard gales on transatlantic tracks to midocean during Thursday.

A notable storm appeared over the west part of the Gulf of Mexico on the 12th, reached the extreme lower Mississippi Valley the morning of the 13th, and passed eastward off the northern Florida coast during the early morning of the 14th. After leaving the coast the storm moved northeastward and acquired great intensity, and on the 16th the steamship *Trinidad*, bound from New York to Bermuda, experienced a gale of hurricane force.

A third storm of marked strength prevailed along the North Carolina and Virginia coasts during the 21st. This storm also first appeared in the western Gulf district and advanced to the Atlantic coast. On the 20th, when the center of disturbance was crossing Alabama, storm warnings were displayed along the Atlantic coast from Savannah, Ga., to Norfolk and Westpoint, Va., and on the morning of the 21st, when the storm center was off Hatteras, N. C., the following message was telegraphed to Atlantic coast ports from Norfolk, Va., to Portland, Me.

Storm off Hatteras moving northeast. Easterly shifting to northwest gales off north Atlantic and Nova Scotia coasts to-night and off Newfoundland Saturday.

On the Great Lakes high winds occurred from the 7th to the 12th, and on the 23d. During the early morning of the 11th the iron ore barge *Charles Foster* foundered off Erie, Pa., and 8 persons were drowned. Ample warning was given to lake marine interests of the gales of the period December 7 to 12. The display of storm warnings was discontinued for the season on Lake Superior on the 12th, and on Lakes Michigan, Huron, Erie, and Ontario, on the 15th.

On the Pacific coast gales occurred at intervals from the 12th to the 21st, and on the 24th and 25th. On the 14th a heavy storm of wind and rain prevailed in California, and at

San Francisco wind and lightning caused considerable damage and interrupted telegraphic communication. The high winds of the month were anticipated by storm-warning displays.

The only important cold wave of December, 1900, extended from the British Northwest Territory over the interior and western parts of the country during the last three days of the month, causing frost in the valleys of southern California and in Arizona, and carrying the line of freezing temperature into northern Mexico the night of the 31st. On the morning of the 30th special warnings of cold and frost were given the widest possible distribution in southern California, Utah, and Arizona.

Heavy snow fell in the States of the lower Missouri Valley on the 22d. On the 30th, Iowa, Kansas, Nebraska, northern Missouri, and Colorado were swept by cold northerly winds and heavy snow. The storm of the 30th formed a part of the cold wave which covered the greater part of the country during the closing days of the month.

CHICAGO FORECAST DISTRICT.

Storm warnings were ordered at all upper lake ports on the 8th and on Lakes Michigan and Huron on the 12th. After the close of the general navigation season advisory messages were sent to ports on Lake Michigan, where a winter service is maintained. The only cold wave which swept the entire district developed in the British Northwest during the 29th. Cold wave warnings were sent to the extreme Northwest the afternoon of the 29th, and the warnings were extended during the next twenty-four hours over the entire district. The cold wave moved in with great force, and very low temperatures were reported at many stations.—*H. J. Cox, Professor.*

SAN FRANCISCO FORECAST DISTRICT.

Storm warnings were displayed on the middle and north California coast on the 12th and 13th, and on the morning of the 14th the warnings were extended to Port Harford with advisory messages to points farther south. A storm of considerable intensity was fairly in on the north Pacific coast by the morning of the 14th. Both the storm warnings and the rain forecasts were verified. A squall of much violence passed over San Francisco about 1.20 p. m., seventh-fifth meridian time, December 14. At least six flashes of lightning were noted. The wind blew at the rate of 60 miles an hour for one minute and the velocity for five minutes was about 48 miles. The rains of the 16th, 17th, and 18th were forecast, with the exception of southern California, where forecast of showers were not verified. The heavy frosts of the 29th, 30th, and 31st were forecast, and on the morning of the 30th special warnings were sent to 73 places in Utah of much colder weather Monday morning, and to southern California and Arizona giving warning of heavy frost.—*A. G. McAdie, Forecast Official.*

PORTLAND, OREG., FORECAST DISTRICT.

From the 1st to the 12th the month was uneventful. From the 12th to the 21st, inclusive, a succession of severe southerly gales prevailed on the coast and high southerly winds were of frequent occurrence in the interior. A stormy period lasting forty-eight hours set in the evening of the 24th. Both stormy periods were successfully forecast, and storm warnings were displayed during the entire time of danger at the mouth of the Columbia River and at the entrance to the Strait of Juan de Fuca, while advisory messages noting each storm's progress and development were sent as often as necessary to other seaports within the district. Many vessels remained in port during the displays, and a number of requests for special forecasts were made by masters. A few vessels proceeded to sea without heeding the warnings and their experience, together with that of other vessels which left port several days before notice of the storm's approach could be given, as well as the experience of inward bound vessels, is best told in the accompanying table (not published) compiled from the daily newspapers. The table referred to gives the names of the vessels damaged by storms during the month, and the extent of the damage caused, together with the ports arrived at and departed from with dates of arrival and departure.

A river forecast was issued on the 21st announcing a stage of about 14 feet in the Willamette on the 24th. A stage of 13.1 feet was reached on the 24th. The forecast was of value as it quieted the fears of those who thought the danger line of 15 feet would be passed.—*E. A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

During the month there were charted eleven highs and twelve lows. A brief description of their more prominent characteristics is given herewith.

Highs.—The practically permanent winter high over the Plateau region which had prevailed during more than two-thirds of the previous month, continued throughout the month with but three day's interruption, on the 14th, 20th, and 21st. There was also a high stationary on the south Atlantic coast from the 14th to the 19th, inclusive.

The principal tracks of the charted highs were either southeastward from the British Northwest Territory to the middle Mississippi Valley, and thence eastward to the Atlantic coast between latitudes 35° and 40°, or else directly eastward across Canada. No. III divided at its place of origin in Manitoba, one section moving directly eastward over Canada to the Atlantic Ocean, and the other due southward to eastern Texas, where it dissipated. No. XI also divided after traveling to Manitoba from eastern British Columbia, one section moving eastward to central Ontario, where it disappeared, and the other southeastward by way of Lake Michigan and the State of Ohio to the southern New Jersey coast.

Nos. I, II, VII, and VIII all originated in the eastern half of the country, and were only of moderate intensity. No. VIII was a south Atlantic coast high that passed into the ocean after reaching the North Carolina coast. It was last observed about 300 miles north of the Island of Bermuda, traveling northeastward.

Lows.—All the lows, with the exception of Nos. V, IX, and XII originated west of the one hundred and tenth meridian, and five of them north of the fiftieth parallel. No. V originated in southeastern Texas, moved eastward to the Atlantic Ocean, and was last noted at the Island of Bermuda. No. IX also originated in eastern Texas, and moved eastward to the south Atlantic coast, from whence it turned northward along the coast, disappearing to the eastward after reaching the Nova Scotia coast. No. XII originated in the Texas panhandle, and dissipated in central Pennsylvania after a rapid existence of only twenty-four hours. Nos. I and XI were of a similar type. At the outset each consisted of two widely separated storms, one section originating in Alberta and the other in southeastern Texas. The lower ones moved northeastward through the east Gulf and Atlantic coast States. The two sections of No. I united over southern New York, and thence continued as one storm northeastward to the Atlantic Ocean by way of St. Johns, N. F. The lower section of No.

XI also moved northeastward along the Atlantic coast, but was not joined by the upper section until its last appearance over Cape Breton Island. The low chartered as No. X was a peculiar combination of barometric conditions. It began as two distinct depressions over Alberta, with an interval of thirty-six hours between them. The earlier one moved with quite rapid velocity over the British Northwest Territory to western Ontario, and thence southeastward to eastern Lake Erie, where it was joined by the second and later section, which had traveled with a velocity of over 65 miles an hour southward to the Texas panhandle, and thence northeastward through the Ohio Valley. The combined depression then continued its rapid movement through Newfoundland into the Atlantic Ocean. When the second section reached Oklahoma it sent off a third section which proceeded as a separate low of moderate intensity to the Louisiana coast, and thence eastward, being finally noticed at the Island of Bermuda. Nos. VI, VII, and VIII appeared in rapid succession off the north Pacific coast, moved northward to British Columbia, and thence eastward, No. VI dissipating over Manitoba, and Nos. VII and VIII continuing over Canada to the ocean.—*H. C. Frankenfield, Forecast Official.*

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, p. m.	40	84	3, a. m.	38	75	600	1.5	400	16.7
II	5, a. m.	32	95	6, p. m.	35	75	1,150	1.5	767	32.0
III	6, p. m.	50	99	8, p. m.	46	60	1,875	2.0	938	39.1
				9, a. m.	32	96	1,400	2.0	700	29.2
IV	8, a. m.	54	114	10, p. m.	39	82	2,000	2.5	800	33.3
V	10, a. m.	53	108	12, a. m.	35	75	2,350	2.0	1,175	49.0
VI	12, a. m.	53	108	18, a. m.	43	74	1,800	6.0	300	12.5
VII	20, a. m.	42	92	21, p. m.	47	71	1,175	1.5	783	32.6
VIII	21, p. m.	33	80	24, a. m.	37	63	1,100	2.5	440	18.3
IX	23, a. m.	53	108	28, a. m.	32	65	2,900	5.0	580	24.2
				27, a. m.	46	74	1,850	4 0	462	19.2
X	25, p. m.	41	124	30, a. m.	32	65	3,850	4.5	856	35.7
XI	29, a. m.	53	121	3, a. m *	46	78	1,900	4.0	475	19.8
				4, a. m *	40	75	2,400	5.0	480	20.0
Sums							26,350	44.0	9,156	381.6
Mean of 14 paths							1,882		654	27.3
Mean of 44 days									598	24.9
Low areas.										
I	2, a. m.	26	97	6, a. m.	48	54	3,000	4.0	750	31.2
	2, a. m.	54	114				3,350	4.0	838	34.9
II	4, p. m.	54	114	8, p. m.	32	65	3,080	4.0	770	32.1
III	6, p. m.	54	114	10, a. m.	46	60	2,550	3.5	729	30.4
IV	11, a. m.	51	114	14, a. m.	46	60	2,550	3.0	850	35.4
V	12, a. m.	28	97	15, a. m.	32	65	2,150	3.0	717	29.9
VI	13, p. m.	48	122	16, p. m.	50	97	1,325	3.0	441	18.4
VII	15, a. m.	47	123	20, p. m.	46	60	3,150	5.5	573	23.9
VIII	18, p. m.	45	123	27, a. m.	48	54	4,500	8.5	529	22.0
IX	18, p. m.	30	98	22, a. m.	45	64	2,300	3.5	657	27.4
	24, a. m.	54	114				3,125	4.0	781	32.5
X				28, a. m.	48	54	3,925	2.5	1,570	65.4
				29, a. m.	32	65	3,650	3.5	1,043	43.5
XI	28, p. m.	54	114	31, p. m.	46	60	2,500	3 0	833	34.7
	29, a. m.	29	95				2,250	2.5	900	37.5
XII	30, a. m.	35	102	31, a. m.	41	78	1,375	1.0	1,375	57.3
Sums							44,780	58.5	13,356	556.5
Mean of 16 paths							2,799		835	34.8
Mean of 58.5 days									765	31.9

*January.

RIVERS AND FLOODS.

River stages during the month were not of such a character as to invite particular mention. The moderate Ohio River flood of the latter days of November reached the Mississippi River during the first days of the month, and much higher, though not dangerous, stages prevailed below Cairo, Ill., throughout the month. Heavy rains on the 3d and 4th also caused a sharp rise for a day or two in the rivers of the east Gulf and South Atlantic States, but without serious effects; elsewhere stages were generally lower than during November, except in the Pacific States. The following special report on the Columbia and Willamette rivers was made by Mr. E. A. Beals, Forecast Official, in charge of the Portland, Ore., forecast district.

The Columbia River during December remained at its normal low winter stage. Heavy rains on the 19th and 20th caused a small rise in the Willamette River during the 21st, 22d, 23d, and 24th. At Eugene, near its headwaters, a stage of 13.6 feet or 3.6 feet above the danger line was reached on the 21st. The highest water at Albany was 18.5 feet on the 23d; at Salem, 18 feet on the same day, and at Portland, 13.1 feet on the 24th. These readings were from a foot to two feet below the danger line at each place, and the freshet, instead of doing damage, was of benefit, as it enabled lumbermen to float large quantities of logs lying just above ordinary water to the sawmills below. Small steamboats also took advantage of the rise to visit places further up stream than usual, and obtain loads of farm produce, which they transported to Portland.

In order to quiet the fears of those having property endangered, a special river forecast was issued December 21, which announced that a gage reading of over 14 feet at Portland was not expected, and it was of value as the lower city docks and cellars are flooded when the river reaches 15 feet. The freshet quickly subsided, and at the close of the month the Willamette River was at its normal stage.

The average stages in the Sacramento River were also from 3 to 4 feet higher than during November.

The Mississippi River at St. Paul, Minn., became gorged with ice on the 16th and froze over on the night of the 24th. At Reads Landing, Minn., it froze over on the 31st. At La Crosse, Wis., the river closed at 1 p. m. of the 14th, after a rapid rise of 2 feet, due to an ice gorge a short distance below the city. It again opened in the vicinity of the station on the 22d. At Prairie du Chien, Wis., the river closed on the 11th; at Dubuque, Iowa, on the 29th, and at Leclaire, Iowa, on the 25th. At the end of the month it had not closed as far south as Davenport, Iowa, although floating ice was quite general at that place after the 9th. The first ice passed Keokuk, Iowa, on the 10th; Hannibal, Mo., on the 12th, and Grafton, Ill., on the 13th. None was reported below the mouth of the Missouri River. The Missouri River was frozen over during the entire month to below Sioux City, Iowa, and by the 25th to within 3 miles above Omaha, Nebr. Floating ice first reached St. Joseph, Mo., on the 11th, and Kansas City, Mo., on the 28th. No ice was observed in the Ohio River below Parkersburg, W. Va., nor was there much of consequence in the rivers of the Middle Atlantic States. Taken as a whole, there was much less ice in the rivers during the month than during the corresponding month of 1899. At the close of December, 1899, the ice was 4 inches in thickness as far south as Lynchburg, Va., on the James River, 5 inches at Louisville, Ky., on the Ohio River, and 8 inches at Hannibal, Mo., on the Mississippi River. The southern limit of floating ice was about 300 miles further north in December, 1900, than in December, 1899, when it extended into North Carolina.

The highest and lowest water, mean stage, and monthly range at 128 river stations are given in Table XI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Precipitation is expressed in inches and temperature in degrees Fahrenheit.

Alabama.—The mean temperature was 46.9°, or about normal; the highest was 76°, at Elba on the 23d, and the lowest, 20°, at Gadsden on the 11th and at Valleyhead on the 13th. The average precipitation was 4.68, or 0.52 above normal; the greatest monthly amount, 11.54, occurred at Newton, and the least, 2.46, at Decatur and Madison.

The month was mild and generally favorable for farm work.—*F. P. Chaffee.*

Arizona.—The mean temperature was 48.2°, or about normal; the highest was 92°, at Champies Camp on the 11th, and the lowest, 7° below zero, at Flagstaff on the 31st. The average precipitation was 0.03, or 1.05 below normal; the greatest monthly amount, 0.60, occurred at Vail, while none fell at a great number of stations.—*W. G. Burns.*

Arkansas.—The mean temperature was 44.9°, or 1.8° above normal; the highest was 82°, at Ione on the 17th and at Bee Branch on the 18th, and the lowest, 10°, at Mossville on the 31st. The average precipitation was 2.76, or 1.54 below normal; the greatest monthly amount, 8.28, occurred at Dallas, and the least, 0.46, at Arkansas City.

The moderate temperature and good rains were beneficial to winter wheat; the stand of early sown was exceptionally good for December, but late sown, while looking fair, was not doing so well. Many fields of early sown were infested with hessian fly.—*E. B. Richards.*

California.—The mean temperature was 47.3°, or 0.8° above normal; the highest was 90°, at Irvine on the 1st, 3d, and 7th, and the lowest, 25° below zero, at Bodie on the 31st. The average precipitation was 1.68, or 2.36 below normal; the greatest monthly amount, 12.31, occurred at Upper Mattole, while none fell at 37 stations.—*A. G. McAdie.*

Colorado.—The mean temperature was 29.3°, or 3.1° above normal; the highest was 78°, at Blaine on the 27th, and the lowest, 32° below zero, at Walden on the 31st. The average precipitation was 0.28, or 0.55 below normal; the greatest monthly amount, 1.30, occurred at Santa Clara, and the least, trace, at a number of stations.—*F. H. Brandenburg.*

Florida.—The mean temperature was 58.9°, or 0.6° below normal; the highest was 89°, at Miami on the 13th and at Lake Butler on the 31st, and the lowest, 26°, at St. Francis and Sumner on the 26th. The average precipitation was 4.52, or 1.90 above normal; the greatest monthly amount, 8.27, occurred at Carrabelle, and the least, 0.69, at Key West.—*A. J. Mitchell.*

Georgia.—The mean temperature was 46.9°, or 1.2° below normal; the highest was 80°, at Waycross on the 23d, and the lowest, 19°, at Dahlonega on the 11th. The average precipitation was 5.63, or 2.18 above normal; the greatest monthly amount, 10.90, occurred at Fort Gaines, and the least, 2.76, at Waycross.

The general effect of the weather was highly beneficial to fruit and agricultural interests. The absence of any warm periods prevented the flow of sap in fruit trees, and the conditions of orchards throughout the State is considered good. Winter wheat has come up to fine stands and is growing well.—*J. B. Marbury.*

Idaho.—The mean temperature was 31.1°, or 4.8° above normal; the highest was 58°, at Payette on the 20th, and the lowest, 34° below zero, at Swan Valley on the 31st. The average precipitation was 1.48, or 0.24 below normal; the greatest monthly amount, 5.53, occurred at Moscow, and the least, 0.10, at Downey.—*S. M. Blandford.*

Illinois.—The mean temperature was 32.2°, or 1.2° above normal; the highest was 66°, at Greenville on the 2d and at St. John on the 22d, and the lowest, 3° below zero, at Kishwaukee and Riley on the 31st. The average precipitation was 0.93, or 1.22 below normal; the greatest monthly amount, 2.90, occurred at Cobden, and the least, 0.02, at Bushnell.

The weather was generally favorable. Wheat was generally in good condition, with the exception of some damaged by hessian fly in the central and southern portions.—*M. E. Blystone.*

Indiana.—The mean temperature was 33.2°, or 0.4° above normal; the highest was 73°, at Boonville on the 23d, and the lowest, 2° below zero, at Bluffton on the 11th. The average precipitation was 1.20, or 1.35 below normal; the greatest monthly amount, 3.10, occurred at Mount Vernon, and the least, 0.01, at Winamac.

Mild and dry weather prevailed during the month and fields were without snow covering. Rye and wheat looked green, and in the southern portion made good growth. The hessian fly injured early-sown wheat in many localities. Much plowing was done during the month and farm work in general was well advanced. More corn fodder was shredded than in previous years. Live stock is fat and in good condition.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 26.9°, or 3.3° above normal; the highest was 62°, at Albia on the 23d, and the lowest, 10° below zero, at Primghar, Sibley, Sioux Center, and Spirit Lake on the 31st. The average precipitation was 0.45, or considerably below normal; the greatest monthly amount, 2.70, occurred at Vinton, and the least, trace, at Bonaparte, Clear Lake, and Mooar.—*J. R. Sage, Director; G. M. Chappel, Assistant.*

Kansas.—The mean temperature was 35.2°, or 1.9° above normal; the highest was 78°, at Ulysses on the 22d, and the lowest, 15° below zero, at Tribune on the 30th and at Colby on the 31st. The average precipitation was 0.34, or 0.65 below normal; the greatest monthly amount, 0.93, occurred at Campbell, and the least, trace, at Coolidge, Tribune, and Scott.

The mild, dry weather was quite favorable for farm work, and much plowing for spring seeding was done. Wheat continued in fine condition in the central and eastern counties, and was still being pastured to prevent too rapid growth, though that was checked in a measure by the dry weather; in the western counties a long drought stopped growth of wheat and checked germination of seed in the soil, but sowing continued through the month.—*T. B. Jennings.*

Kentucky.—The mean temperature was 38.6°, or 0.7° above normal; the highest was 70°, at Warfield on the 3d, and the lowest, 12°, at Loretto on the 11th. The average precipitation was 2.59, or 0.61 below normal; the greatest monthly amount, 5.86, occurred at Middlesboro, and the least, 1.23, at Scott.

The month as a whole was very pleasant and was favorable to agricultural interests. Reports on winter wheat are very conflicting, especially as to the amount of damage done by the hessian fly. There is no doubt that many fields of early sown wheat have suffered severely from the ravages of the pest, and some of the later fields are affected in a lesser degree; the extent of this damage can not be closely estimated until the spring.—*H. B. Hersey.*

Louisiana.—The mean temperature was 52.2°, or about normal; the highest was 83°, at Lake Providence on the 1st, and the lowest, 23°, at North Louisiana Experiment Station on the 9th. The average precipitation was 5.58, or 1.54 above normal; the greatest monthly amount, 12.69, occurred at Wallace, and the least, 1.35, at Robeline.

Exceptionally favorable weather for farming interests prevailed during the month.—*W. T. Blythe.*

Maryland and Delaware.—The mean temperature was 34.4°, or 1.2° below normal; the highest was 68° at Hagerstown, Md., on the 24th, and the lowest, 2° below zero, at Sunnyside, Md., on the 17th. The average precipitation was 2.43, or 0.29 below normal; the greatest monthly amount, 4.10, occurred at Mount St. Marys, Md., and the least, 1.51, at Clearspring, Md.

The early and middle sowings of wheat are more promising than the late sown, which is rather thin in places. Here and there the fly has worked some damage to early wheat, but not enough to cause any particular apprehension. It has been a remarkable winter for grass thus far, many pastures still affording fairly good grazing at the close of December.—*Oliver L. Fassig.*

Michigan.—The mean temperature was 26.8°, or 1.0 above normal; the highest was 60°, at Plymouth on the 3d, and the lowest, 18° below zero, at Humboldt on the 27th. The average precipitation was 0.76, or 1.45 below normal; the greatest monthly amount, 3.25, occurred at Chatham, and the least, trace, at Birmingham and Port Austin.

The condition of winter wheat did not improve materially during the month. Lack of snow protection most of the month, with alternate freezing and thawing, were detrimental, and at the close of the month the condition of wheat was poor. Correspondents quite generally noted the presence of hessian fly.—*C. F. Schneider.*

Minnesota.—The mean temperature was 18.6°, or 2.0° above normal; the highest was 51°, at Beardsley on the 3d, and the lowest, 45° below zero, at Pokegama on the 31st. The average precipitation was 0.51, or 0.21 below normal; the greatest monthly amount, 1.31, occurred at at Grand Meadow, and the least, 0.06, at Ada.

It is said that in the logging regions enough snow fell on the 24th for the beginning of hauling to be made. Navigation on Lake Superior was open to December 20, with expectation that boats would continue running for some time between Duluth and north shore points of Minnesota.—*T. S. Outram.*

Mississippi.—The mean temperature was 48.3°, or 0.4° below normal; the highest was 78°, at Brookhaven on the 7th and at Leakesville on the 22d, and the lowest, 21°, at Jackson on the 9th. The average precipitation was 4.04, or 0.14 below normal; the greatest monthly amount, 8.76, occurred at Leakesville, and the least, 1.27, at Macon.—*W. S. Belden.*

Missouri.—The mean temperature was 35.8°, or 2.0° above normal; the highest was 68°, at Mount Vernon on the 2d, and the lowest, 3° below zero, at Maryville on the 31st. The average precipitation was 0.72, or 1.47 below normal; the greatest monthly amount, 3.45, occurred at Sikeston, and the least, 0.05, at Sedalia.

It was the driest December during the past thirteen years. In a few of the eastern counties wheat was reported a little thin on the ground, as the result of dry weather at seeding time, and in localities in the east-central and southern counties early sown wheat showed much damage by fly, some fields being practically ruined, but the late sown was generally uninjured, and the crop as a whole was in excellent condition at the close of the month. Fall pastures held out remarkably well, and in many sections comparatively little feeding of stock was necessary.—*A. E. Hackett.*

Nebraska.—The mean temperature was 31.9°, or 5.9° above normal; the highest was 74°, at Benkelman on the 19th and 23d, and the lowest, 25° below zero, at Madrid on the 31st. The average precipitation was 0.31, or 0.37 below normal: the greatest monthly amount, 1.25, occurred at Odell, while none fell at Madrid and Smithfield.—*G. A. Loveland.*

Nevada.—The mean temperature was 33.1°, or about 3.0° above normal; the highest was 71°, at Candelaria on the 4th and 6th, and the lowest, 11° below zero, at Monitor Mill on the 31st. The average precipitation was 0.19, or 1.13 below normal; the greatest monthly amount, 2.05, occurred at Lewers Ranch, while none fell at several stations. It was the driest December during the past twelve years.—*J. H. Smith.*

New England.—The mean temperature was 26.0°, or 1.7° below normal; the highest was 61°, at Middletown, Conn., on the 24th, and the lowest, 28° below zero, at Flagstaff, Me., and Berlin Mills, N. H., on the 17th. The average precipitation was 2.27, or 1.24 below normal; the greatest monthly amount, 4.24, occurred at Enosburg Falls, Vt., and the least, 0.97, at Plymouth, N. H.—*J. W. Smith.*

New Jersey.—The mean temperature was 34.4°, or about normal; the highest was 64°, at Paterson and Salem on the 24th, and the lowest, 2° below zero, at Layton on the 17th. The average precipitation was 2.59, or 0.80 below normal; the greatest monthly amount, 3.97, occurred at Woodbine, and the least, 1.47, at Trenton.—*E. W. McGann.*

New Mexico.—The mean temperature was 35.1°, or 1.0° above normal; the highest was 76°, at San Marcial on the 22d, and the lowest, 15° below zero, at Bluewater on the 31st. The average precipitation was 0.41, or 0. 33 below normal; the greatest monthly amount, 1.15, occurred at Gallinas Springs and White Oakes, while none fell at Gage and Lordsburg.—*R. M. Hardinge.*

New York.—The mean temperature was 26.2°, or 0.8° below normal; the highest was 59°, at Jamestown on the 23d, and the lowest, 25° below zero, at Indian Lake and Jay on the 17th. The average precipitation was 2.38, or 0.71 below normal; the greatest monthly amount, 5.04, occurred at Adams Center, and the least, 0.89, at Ogdensburg.

The month was very favorable for winter grain. In the northeast portion deep snow was continuous, and at the close of the month ample snow protection was general, with but little frost in ground. Full reports showed that wheat and rye were in unusually fine condition, the plant being well rooted, well advanced and showing a healthy color.—*R. G. Allen.*

North Carolina.—The mean temperature was 41.7°, or 0.8° below normal; the highest was 76°, at Newbern on the 4th, and the lowest, 10°, at Linville on the 22d. The average precipitation was 4.50, or 0.76 above normal; the greatest monthly amount, 7.53, occurred at Highlands, and the least, 2.25, at Norfolk.

The condition of winter wheat at the close of the month was very satisfactory; good stands and excellent growth were secured, and late sown came up well. Damage by hessian fly was confined to a very few counties.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 17.3°, or 4.6° above normal; the highest was 58°, at University on the 20th, and the lowest, 29° below zero, at Jamestown on the 12th and at Dunseith on the 31st. The average precipitation was 0.31, or slightly below normal; the greatest monthly amount, 0.92, occurred at Berlin, and the least, trace, at Ellendale and Falconer.—*B. H. Bronson.*

Ohio.—The mean temperature was 31.6°, or 0.8° below normal; the highest was 65°, at Portsmouth on the 22d, and the lowest, 2 below zero, at Bellefontaine on the 17th. The average precipitation was 1.24, or 1.37 below normal; the greatest monthly amount, 2.46, occurred at Portsmouth, and the least, 0.50, at Circleville.

The weather has been favorable for the growth of wheat during the month, except for a lack of precipitation in some central counties. There was a moderate amount of damage by freezing and thawing. The effect of the work of the hessian fly is apparent in the early sown in nearly all sections. The plants from the later seeded fields are generally short, but show a good stand and healthy color in many sections; in others, on the other hand, both early and late sown are very unsatisfactory. Other winter grains and fruit trees are reported to be in good condition.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The mean temperature was 41.9°, or 2.0° above normal; the highest was 74°, at Colbert on the 26th and at Lehigh on the 27th, and the lowest, 9° below zero, at Kenton on the 31st. The average precipitation was 0.52, or 1.44 below normal; the greatest monthly amount, 1.67, occurred at Bengal, while none fell at Tulsa.

Wheat was in very good condition, making a healthy growth, and was generally pastured. Plowing for spring crops was in general progress and well advanced. Some complaints are made that conditions are becoming droughty.—*C. M. Strong.*

Oregon.—The mean temperature was 42.1°, or 3.5° above normal; the highest was 70°, at Merlin on the 18th and at Prineville on the 24th, and the lowest, zero, at Joseph on the 31st. The average precipitation was 6.46, or slightly below normal; the greatest monthly amount, 27.24, occurred at Glenora, and the least, 0.33, at Newbridge.

The month has been favorable for farming operations, and at the close plowing and seeding were practically finished in all sections. The acreage sown to fall wheat is reported as about the same as last year, except in a few counties in the Willamette Valley, where it has been slightly reduced. The early sown stooled nicely and the fields are generally in a promising condition. But few correspondents report damage by the hessian fly, but fears are entertained that this pest will work more or less injury in the spring. The pastures in the western part of the State remained green through the month.—*E. A. Beals.*

Pennsylvania.—The mean temperature was 31.2°, or 0.7° below normal; the highest was 65°, at Coopersburg on the 24th and at Lancaster on the 25th, and the lowest, 2° below zero, at Smethport on the 17th. The average precipitation was 2.08, or 0.98 below normal; the greatest monthly amount, 4.16, occurred at Somerset, and the least, 0.40, at Chambersburg and Smethport.—*L. M. Dey.*

South Carolina.—The mean temperature was 45.5°, or 1.4° below normal; the highest was 79°, at Gillisonville on the 23d, and the lowest, 18°, at Holland on the 26th. The average precipitation was 5.64, or 2.86 above normal; the greatest monthly amount, 8.15, occurred at Effingham, and the least, 3.64, at Batesburg.—*J. W. Bauer.*

South Dakota.—The mean temperature was 26.3°, or about 4.0° above normal; the highest was 68°, at Chamberlain on the 21st, and the lowest, 19° below zero, at Bowdle on the 30th and at Wessington Springs on the 31st. The average precipitation was 0.19, or 0.24 below normal; the greatest monthly amount, 0.70, occurred at Fort Meade, while none fell at Mitchell.—*S. W. Glenn.*

Tennessee.—The mean temperature was 41.7°, or 1.2° above normal; the highest was 70°, at Dover on the 23d and 24th, and the lowest, 12°, at Rugby on the 12th. The average precipitation was 2.78, or 0.98 below normal; the greatest monthly amount, 4.30, occurred at Benton, and the least, 0.74, at Elk Valley.

Generally favorable weather prevailed and wheat made good growth, although rather small for the season, as most of the crop was sown late. Early-sown wheat was badly injured by the hessian fly, but mostly in the eastern and middle divisions; in the western division the crop was generally promising—*H. C. Bate.*

Texas.—The mean temperature was 50.4°, or about normal; the highest was 90°, at Fort Ringgold on the 22d, and the lowest, 1°, at Amarillo on the 31st. The average precipitation was 1.26, or 0.59 below normal; the greatest monthly amount, 5.72, occurred at Houston, while none fell at Hale Center, Henrietta, and Ira.

The deficiency of rainfall which characterized the month over the greater portion of the State was unfavorable to some while it was favorable to other agricultural interests. Wheat seeding, which was well advanced at the opening of the month, was hurried forward during the first decade with very favorable weather, but absence of rainfall proved unfavorable during the second and third decades, and late-sown wheat did not germinate well; early-seeded wheat came up to good stands and in some places was being pastured. Fall gardening is doing very nicely, and as a result the supply of vegetables is about up to the requirements.—*I. M. Cline.*

Utah.—The mean temperature was 30.6°, or 3.9° above normal; the highest was 68°, at Pinto on the 5th, and the lowest, 27° below zero, at Henefer and Woodruff on the 31st. The average precipitation was 0.14, or 0.85 below normal; the greatest monthly amount, 1.30, occurred at Park City, while none fell at a number of stations. It was the driest December since 1878.—*L. H. Murdoch.*

Virginia.—The mean temperature was 38.1°, or 1.9° below normal; the highest was 73°, at Barboursville on the 13th, and the lowest, 8°, at Dale Enterprise on the 17th. The average precipitation was 2.59, or 0.17 below normal; the greatest monthly amount, 4.25, occurred at Bedford City, and the least, 1.30, at Woodstock.

The growth of early sown wheat has thus far been all that could be desired, except some damage by the hessian fly, which, however, has been slight.—*E. A. Evans.*

Washington.—The mean temperature was 40.3°, or about 5° above normal; the highest was 67°, at Sedro-Woolley on the 10th, and the lowest, 7° below zero, at Northport on the 1st. The average precipitation was 6.30, or 0.83 above normal; the greatest monthly amount, 21.81, occurred at Neah Bay, and the least, 0.40, at Sunnyside.

The mild weather was favorable for winter wheat.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 34.6°, or 0.5° below normal; the highest was 66°, at Weston on the 22d and at Creston on the 25th, and the lowest, 3°, at Terra Alta on the 13th. The average precipita-

tion was 2.26, or 0.54 below normal; the greatest monthly amount, 3.45, occurred at East Bank, and the least, 1.22, at Beckley.

Early sown wheat is reported in excellent condition generally over the State, except in the extreme southern portion, where some damage has been done by the fly. Late sown wheat has been injuriously affected by the freezing and thawing, so that it has not made much progress. Some plowing has been done for corn and stock is looking fairly well.—*E. C. Vose*

Wisconsin.—The mean temperature was 23.5°, or 1.6° above normal; the highest was 52°, at Brodhead on the 22d, and the lowest, 21° below zero, at Grantsburg on the 31st. The average precipitation was 0.71, or 0.88 below normal; the greatest monthly amount, 2.11, occurred at Casco, and the least, 0.07, at Delavan.—*W. M. Wilson.*

Wyoming.—The mean temperature was 28.8°, or 4.9° above normal; the highest was 68°, at Fort Washakie on the 7th, and the lowest, 34° below zero, at same station on the 31st. The average precipitation was 0.44, or 0.21 below normal; the greatest monthly amount, 1.18, occurred at Fort Yellowstone, while none fell at Hyattville.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

THE CIRCULATORY MOVEMENTS IN THE ATMOSPHERE.

By Prof. V. BJERKNES.

In the MONTHLY WEATHER REVIEW for October, 1900, pp. 434–443, we have given the complete translation of a memoir by Prof. V. Bjerknes in which he explains in the most elementary manner his excellent ideas as to the geometrical treatment of a general dynamic principle applicable to the movements of the atmosphere. Possibly some of our readers will appreciate the further elucidation of this subject that has just been published by Bjerknes in reply to criticisms by a European student. We have, therefore, prepared the following collection of extracts from Bjerknes' article in the Meteorologische Zeitschrift for November, 1900, pp. 481–491, omitting some matters that are not essential to the proper understanding of his explanations.—ED.

The term gradient is now applied in meteorology to a series of quantities of very various physical significations. But all these quantities have certain common mathematical peculiarities corresponding to the meaning of this word. The gradients are all *directed* quantities, or vector quantities, whose distribution in space can be described by means of a system of surfaces. Along each surface of this system of surfaces a certain nondirected or scalar quantity has a constant value, and corresponding to this property we designate these surfaces by an additional word that is formed from the name of the scalar quantity itself with the prefix iso- or equi-[1]. The gradient is everywhere directed perpendicularly to these surfaces, and shows the direction and the amount of the greatest rate of change in that scalar quantity, which is constant in the direction of the (iso-) or (equi-) surfaces.

It is customary to give the corresponding gradient the same name as that of the scalar quantity. As a typical example, we may consider the temperature. This scalar quantity is constant along the isothermal surfaces. The temperature gradient or the thermal gradient is directed perpendicular to these surfaces and shows the direction and the amount of the greatest fall of temperature.

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I request the readers of my previous memoir to recall that I have used the word gradient only in the sense of the barometric gradient.

For the sake of greater clearness and in order to deduce some general properties of these vector quantities, I will write out the general hydrodynamic equations of motion. If x, y, z are the coordinates of any given particle of fluid, U_x, U_y, U_z are the component velocities, and, consequently,

$$\frac{dU_x}{dt}, \frac{dU_y}{dt}, \frac{dU_z}{dt}$$

are the component accelerations corresponding to these, then the equations of motion can be written in the following simple form, where p is the pressure, q the density, and g, with its components g_x, g_y, g_z is the exterior accelerating force acting upon each unit of mass of the fluid:

$$(1)\qquad \begin{aligned} q\frac{dU_x}{dt} &= -\frac{\partial p}{\partial x} + qg_x \\ q\frac{dU_y}{dt} &= -\frac{\partial p}{\partial y} + qg_y \\ q\frac{dU_z}{dt} &= -\frac{\partial p}{\partial z} + qg_z. \end{aligned}$$

In the case of atmospheric motions, g is the acceleration of gravity and qg the weight of a unit volume of air. On the right-hand side of these equations there also occur those components of the vector quantity about whose proper designation we have spoken, viz, the barometric gradient G, whose components are

$$(2)\qquad \begin{aligned} G_x &= -\frac{\partial p}{\partial x} \\ G_y &= -\frac{\partial p}{\partial y} \\ G_z &= -\frac{\partial p}{\partial z}. \end{aligned}$$

On the other hand, by the space gradient Gr of Möller we must understand a vector quantity whose components along the axes are completely expressed by the right-hand members of the following equations:

$$(3)\qquad \begin{aligned} Gr_x &= -\frac{\partial p}{\partial x} + qg_x \\ Gr_y &= -\frac{\partial p}{\partial y} + qg_y \\ Gr_z &= -\frac{\partial p}{\partial z} + qg_z. \end{aligned}$$

* * * * * * *

The hydrodynamic equations (1) form the starting point of my study. I did not write them out in my previous memoir because I wished to give the demonstration the simplest possible elementary form; but, essentially, these equations did form my starting point, and since the right-hand sides of these equations are the three components of Dr. Möller's "space gradient Gr," therefore I have taken complete account of his vector quantity. It is no error, but rather a very important advantage that this vector does not appear in my result, for the vector Gr is in most cases a very awkward quantity to handle, and it would be difficult to make much advance by using it. In order to make this perfectly plain, I will repeat this portion of the proof in a purely analytical form. I first rearrange the equations (1), in that I divide throughout by the density, q, and then replace the density by its reciprocal, viz, the specific volume, or $k = 1/q$. Thus the equations become

$$(4)\qquad \begin{aligned} \frac{dU_x}{dt} &= -k\frac{\partial p}{\partial x} + g_x \\ \frac{dU_y}{dt} &= -k\frac{\partial p}{\partial y} + g_y \\ \frac{dU_z}{dt} &= -k\frac{\partial p}{\partial z} + g_z. \end{aligned}$$

[1] According to the terminology introduced by Hamilton, and now generally used in mathematical physics, a quantity is said to be *scalar* when its value, at any point in space, can be expressed by a single number; typical examples are density, pressure, temperature, relative humidity, potential, etc. On the other hand, a quantity is said to be a *vector* quantity when three numbers are necessary in order to specify its value at any given point in space. The vector quantities have both magnitude and direction, the three numbers referred to are their components; typical examples are velocity, acceleration, force, and all quantities that we call gradients.

On the left-hand side of the equations in this form are the components of the acceleration, and on the right-hand side, according to the terminology that has been used ever since the days of Sir Isaac Newton, we have the total accelerating force. This total accelerating force is the sum of two simpler accelerating forces, viz, the accelerating gravity, g, also known more simply as the acceleration of gravity, and again the accelerating force due to the barometric gradient, whose components along the respective axes are:

$$-k\frac{\partial p}{\partial x}, -k\frac{\partial p}{\partial y}, -k\frac{\partial p}{\partial z}.$$

Now let ds be the line element of a curve consisting of particles of the fluid, and dx, dy, dz, be the projections of this element on the coordinate axes. Multiply the equations (4) respectively by dx, dy, dz, add the products and integrate along the whole curve under the assumption that it is a closed curve; there results the following:

$$\int\left\{\frac{dU_x}{dt}dx+\frac{dU_y}{dt}dy+\frac{dU_z}{dt}dz\right\}=$$

$$(5)\qquad =-\int k\left(\frac{\partial p}{\partial x}dx+\frac{\partial p}{\partial y}dy+\frac{\partial p}{\partial z}dz\right)$$

$$+\int\left(g_x\,dx+g_y\,dy+g_z\,dz\right)$$

The integral on the left hand, under the special assumption that the curve is closed can be written in the form

$$(6)\qquad \frac{d}{dt}\int(U_x dx+U_y dy+U_z dz).$$

This transformation is given in Lord Kelvin's original proof of his theorem as to the conservation of circulatory motion,[2] and is also, in a more or less complete form, to be found in all text-books that teach this theory.[3] Moreover, the same transformation is given in the developments on Pages 100 and 101 of my memoir.[4] The quantity following the integral sign in equation (6) is simply the circulation, C, of the curve, according to the terminology introduced by Lord Kelvin. Therefore, the left-hand side of equation (5) reduces to $\frac{dC}{dt}$, which is the increase in the circulation of the curve within a unit of time.

The first integral on the right-hand side of equation (5) also has a simple meaning. The expression within the parenthesis, viz:

$$\frac{\partial p}{\partial x}dx+\frac{\partial p}{\partial y}dy+\frac{\partial p}{\partial z}dz$$

can also be written

$$\frac{\partial p}{\partial s}ds.$$

But $-\frac{\partial p}{\partial s}$ is nothing else than the component of the barometric gradient, G, that is tangential to the curve. If we designate this tangential component by G_t then the integral can be written simply as

$$(7)\qquad \int kG_t\,ds.$$

Finally, the second integral on the right-hand side of equation (5) disappears identically along the closed curve, if g represents the acceleration of gravity; for every force for which this integral does not disappear will, as is well known, maintain a perpetual motion.

[2] Sir William Thomson On Vortex Motion, Trans. Roy. Soc., Edinburgh, 1869, Vol. XXV, p. 217.

[3] See, for example, Poincaré's Théorie des Tourbillons, p. 12, Paris, 1893.

[4] See Met. Zeitschr., March, 1900, or MONTHLY WEATHER REVIEW, October, 1900, p. 435.

Therefore, finally, equation (5) reduces to the following:

$$(8)\qquad \frac{dC}{dt}=\int k\,G_t\,ds$$

If we recall that kG represents the accelerating force arising from the barometric gradient, and, further, that by the line-integral of a vector quantity we always understand the line-integral of the component tangential to the curve, then the equation (8) can be expressed in words as follows: *The increase of circulation in a unit of time of a closed curve is equal to the line-integral of that accelerating force which arises from the barometric gradient.*

This theorem is identical with that given in my previous memoir,[5] viz, that the increase of circulation is equal to the number of the solenoids inclosed within the curve. In fact, the number of the solenoids, A, is simply another expression for the above integral (No. 7).

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It will be noticed that in passing from equation (1) to the equations (4), we no longer have to do with the quantity Gr, or the "space gradient" of Möller, as such, but with its product into the specific volume. In the integration along the closed curve, the gravity term drops out in consequence of the conservative nature of this force, so that only the barometric gradient multiplied by the specific volume remains under the integral sign.

Of course this does not mean that the gravitating force has no importance in the circulation of the air, but only that, in the method of computation here applied, this force does not enter explicitly into the formula. As seen from the point of view here chosen, its action is indirect; it exerts a joint influence on the distribution of pressure and density, and its influence is, therefore, indirectly included in the integral.[6] As will be shown by Sandström in a memoir soon to be published, this influence of the gravitating force may also be made to stand forth explicitly. But it appears that invariably, in the computation of the circulation, the knowledge of either the barometric gradient or the gravitating force, alone, in connection with the density or the specific volume of the air, will suffice, whereas we never need to know the complete "space gradient, Gr."

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If a vector quantity is given in space, we can always draw curves that shall be everywhere tangent to the direction of the vector; but, as is known to every geometer, it is only exceptionally possible to construct curved surfaces that shall be everywhere perpendicular to those curves, and, therefore, also to the vector quantities themselves. If we indicate any vector quantity by U and its components along the axes by U_x, U_y, U_z, then a surface normal to the vector quantity, U, can only be constructed when the three quantities U_x, U_y, U_z, satisfy the following equation:

$$(9)\quad U_x\left(\frac{\partial U_z}{\partial y}-\frac{\partial U_y}{\partial z}\right)+U_y\left(\frac{\partial U_x}{\partial z}-\frac{\partial U_z}{\partial x}\right)+U_z\left(\frac{\partial U_y}{\partial x}-\frac{\partial U_x}{\partial y}\right)=0$$

We have here to do with a general principle long since known to geometers, but which one in his haste, easily overlooks. For it seems easy to say that we may draw a surface element normal to each individual curve of a system of curves, and that the totality of all these elementary surfaces must constitute a continuous system of surfaces perpendicular to the original curves; but the incompleteness of this statement is readily recognized when we consider a simple example. For instance, let the curves resemble the fibers of an ordinary twisted thread. If we attempt to imagine the nature of the

[5] Met. Zeitschr., p. 106, or MONTHLY WEATHER REVIEW, pp. 437–8.

[6] The attention of the reader is called to the fact that in fig. 8, Met. Zeitschr., 149, or MONTHLY WEATHER REVIEW, p. 439, the vertical arrow on the right-hand side should point downward, not upward, as in the figure.

surface we see at once that it is impossible to draw any surface perpendicular to curves that have such courses as these. If we twist the fiber backward so that it is made up of parallel straight lines then we can draw a plane surface perpendicular thereto. For different degrees of bending or deformation of such a bundle of fibers, this plane will be curved and deformed, but still without ceasing to constitute a connected surface. But the instant that we twist the bundle of fibers the plane will break into individual elementary surfaces that can no longer be combined into a continuous surface.

Now, equation (9) expresses the mathematical condition that the curves running tangential to the vector quantities shall show no such torsion as those of the fibers of a thread. In order to investigate the relation of the vector quantity, *Gr*, in reference to this property, we may insert in equation (9) the values of the components as given in equation (3). After a simple reduction there results the following:

$$(10) \qquad \frac{\partial p}{\partial x}\left(g_z\frac{\partial q}{\partial y}-g_y\frac{\partial q}{\partial z}\right)+\frac{\partial p}{\partial y}\left(g_x\frac{\partial q}{\partial z}-g_z\frac{\partial q}{\partial x}\right)$$

$$+\frac{\partial p}{\partial z}\left(g_y\frac{\partial q}{\partial x}-g_x\frac{\partial q}{\partial y}\right)=0$$

The discussion of this equation, according to regular geometrical methods, leads to the following results: it will be satisfied, and then only, when a system of curves can be given along which, and simultaneously, three scalar quantities are constant, viz: density, pressure, and the potential of gravity. These curves must, necessarily, lie in the level surfaces of gravity, and the condition that must be satisfied may therefore be formulated as follows: The equation (10) will be satisfied when in every level surface of gravity a system of curves can be drawn such that along every curve the value both of the density and of the pressure is constant. This condition, as may easily be seen, can be fulfilled in a series of special cases, which are completely enumerated in the following list:

1. When the pressure is constant throughout the whole space.
2. When the density is constant throughout the whole space.
3. When the surfaces of equal pressure coincide with the level surfaces of gravity.
4. When the surfaces of equal density coincide with the level surfaces of gravity.
5. When the surfaces of equal pressure and those of equal density coincide with each other.
6. When the lines of intersection of the surfaces of equal pressure and equal density fall in the level surfaces of gravity.

The first case is at present of no importance. The second case is important, since this condition is always fulfilled when the fluid is homogeneous and incompressible. The distribution of the moving forces in such a fluid can, therefore, be expressed by a diagram of isostenes, or isostenic surfaces [which term is applied by Möller to surfaces that are perpendicular to the space gradient or the vector quantity, *Gr*]. If p is the pressure and φ the potential of gravity, then the equation of these isostenic surfaces is

$$\varphi - p = \text{constant},$$

and in the solution of special problems these will often find application in the literature of hydrodynamics. In this case the vector, *Gr*, is a quantity of the nature of a gradient. The conditions (3) and (4) can be momentarily fulfilled in the course of any movement, but only to be not fulfilled in the next moment. In such isolated moments, therefore, isostenic surfaces can be drawn, but only to disappear in the next instant. These conditions can be permanently fulfilled only in the case of equilibrium. On the other hand, case (5) is important because the condition that the surfaces of equal density and equal pressure shall agree will always be fulfilled if we assume that the density is a function of the pressure only. In this case, also, there exist isostenic surfaces whose equation can, in general, be written as

$$\varphi - \int \frac{dp}{q} = \text{constant},$$

and these will find frequent application in the solution of special problems. All movements of the type of sound waves also belong to the category of atmospheric motions that we may study under the assumption that the density of the air depends only on the pressure. In this category, also, belongs the concrete example of the courses of the isostenic surfaces that was given by Möller.[7] Finally, case (6) refers to fluid media of the most general nature, and the condition now in question is again such an one as can only be fulfilled accidentally, for an instant, and in the next instant will in general cease to be fulfilled.

Therefore, the isostenic surfaces will, in general, be useful only in cases (2) and (5) that is to say, in homogeneous, incompressible fluids and in fluids where the density is a function of the pressure only. But it is precisely to these two cases that the celebrated Helmholtz-Kelvin theorem relates, according to which a circulatory motion can not be initiated, and, inversely, a circulatory motion once established also can not be annihilated. When we make these special assumptions, as to the property of the fluid, we thereby exclude the possibility of discussing circulatory motions in the atmosphere.

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Finally, I return to the terminology, which we meet with in dynamic meteorology, of the directed quantities distributed throughout all space.

In dynamic meteorology we meet first with two vector quantities distributed throughout the whole space and which belong to the simplest category of vector quantities. These are: (1) The force of gravity acting on a *unit of mass*, generally called the acceleration of gravity, and (2) the moving force resulting from pressure acting on the *unit volume*, or the quantity that I have here called the barometric gradient. These vector quantities have not only the property that one may draw surfaces perpendicular to them, viz, the level surfaces of gravity, or the isobaric surfaces of pressure, but we may also, by means of these surfaces, express the magnitude of the vectors, since the latter are inversely proportional to the thickness of the layer between two consecutive surfaces. Therefore, in accordance with Lord Kelvin's notation, these two vector quantities belong to the category of lamellar vector quantities. The conception of a lamellar vector is in mathematical sense identical with the conception of a gradient.

Next after these two simplest vector quantities, we meet two of a somewhat more complex nature, namely, the product of the density of the air by the acceleration of gravity and, again, the product of the specific volume of the air by the barometric gradient. The first of these quantities is the force of gravity acting on a unit of volume or the weight of a unit volume of air, understanding by this weight a directed quantity distributed throughout the whole space. The second of these quantities is the force resulting from the pressure acting upon a unit of mass. This is the vector quantity that we encountered in developing the theorem above given, as expressed in equation (3), and represents the accelerating force corresponding to the gradient of pressure. These two

[7] Met. Zeitschr., 1895, p. 92.

vector quantities have the further property of standing perpendicular to a system of surfaces, viz, the system of level surfaces, or isobaric surfaces, respectively. But the magnitudes of these quantities can no longer be expressed by the thickness of the lamella between the successive surfaces, but for this purpose we must introduce a second system of surfaces, viz, the surfaces of equal density, or equal specific volume. These two vector quantities therefore belong to the category of complex lamellar vector quantities that Lord Kelvin has so called on account of the two systems of surfaces and lamellæ. Therefore, in the strict sense of the word, these quantities are not of the nature of gradients. The importance of these vector quantities depends especially upon the fact that they are the simplest quantities upon which we can base the computation of the circulatory motions of the atmosphere. The accelerating barometric gradient is the vector quantity whose tangential component appears under the sign of integration in equation (8), and the tangential component of the weight of a unit volume of air will occur under the integration sign in the corresponding integral when we describe the circulation by the use of the specific moving quantities, viz, the product of velocity and density, instead of by velocity alone.

By the combination of a simple lamellar vector quantity (the barometric gradient) and a complex lamellar vector (the weight of the air in a unit of volume) there arises that vector quantity which Möller has called "the space gradient," *Gr*.

It therefore seems to me important to earnestly warn against the use of the term *gradient* for this vector quantity. Since, misled by the name gradient, we are liable to attribute to it the properties of a gradient, and be led into further error with respect to the isostenic surfaces. Moreover, a special name for this quantity is entirely unnecessary, for in mathematical relations it is nothing else than a vector quantity, and in mechanical aspects it is a force of a most general nature. The retention of the name gradient would also be equivalent to saying that in meteorology we call that a gradient which in mechanics is called force, and that in meteorology we speak of magnitudes of the nature of the gradient, when the mathematician speaks of vector quantities. This special name can be useful only when we apply the term gradient in a mechanical sense to forces of a very special nature, and in a mathematical sense to vectors of a very special nature, and then alone would the name have a prospect of being accepted from meteorology into the mathematical and mechanical sciences, and of assisting instead of hindering the cooperation of these sciences in meteorological questions.

The rational introduction of a terminology will, therefore, encounter no serious difficulty where the term gradient is used only in the above-mentioned special sense; but so far as I know no other meteorologist has accepted and used this special gradient. Only in one point do we come into disagreement with the old usage, viz, by the term vertical gradient we generally mean, not the vertical gradient of pressure, but the difference between the vertical gradient of pressure and the force of gravity. This is the vertical component of Möller's gradient. So long as we retain this term, instead of speaking of the vertical force, it will be very easy to call the general force directed at random in space, the *space* gradient, and misled by this name to attribute to this force the properties of the gradients and thereby again find ourselves tending toward the errors with regard to isostenic surfaces. Therefore, it would seem best not to make any further use of the term vertical gradient in the above sense, which is in fact not generally done, but to indicate the difference between the two forces by the simple term "vertical force."

LINE INTEGRALS IN THE ATMOSPHERE.

By FRANK H. BIGELOW.

The papers by Prof. V. Bjerknes[1], in connection with a criticism thereon[2] by Dr. M. Möller, and a practical application of the theory to a cyclone, by Dr. J. W. Sandström[3], have brought before meteorologists a problem of interest and practical importance. It is, therefore, desirable to investigate the bearings of the theory from various points of view. The following contribution to the subject is not intended as a criticism of the preceding works, but as a supplement to the discussion of the subject given by Prof. V. Bjerknes himself.[4]

What the theory is may readily be described in the following manner: The well known diagram by Hertz of the adiabatic changes in the condition of moist air, Abbe's translations, On the Mechanics of the Earth's Atmosphere, shows the relations between pressure B, temperature t, and vapor tension e, in the four stages, $\alpha, \beta, \gamma, \delta$. Now, since the density ρ is a function of B, t, e, only, a similar diagram will result for the function ρ, the density, and hence for the specific volume $v = \frac{1}{\rho}$, by drawing other lines on the same coordinate axes.

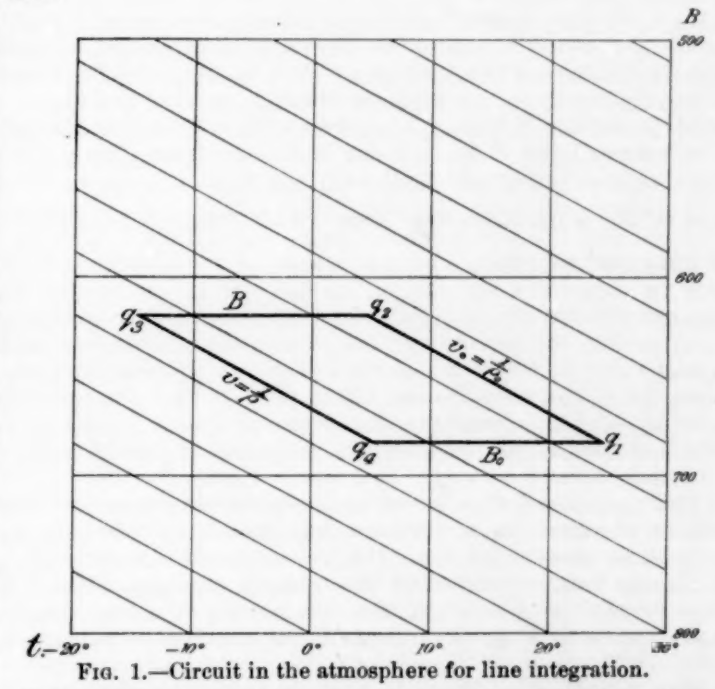

FIG. 1.—Circuit in the atmosphere for line integration.

Using throughout this paper the notation laid down in my International Cloud Observations Report, on pages 485–488, and also the formulæ derived in the sections following, we have

$$\frac{1}{\rho} = \frac{P_0(1+\alpha t)}{\rho_0 P} \text{ for dry air,} \qquad 47a;$$

$$\text{and } \frac{1}{\rho} = \frac{1}{\rho_0}\frac{B_0}{B}(1+\alpha t)(1+\beta)(1+\gamma)\left(1+\frac{h+h_0}{R}\right).$$

$$= \frac{1}{\rho_0}\frac{760}{(B-.377e)}\cdot\frac{1+\alpha t}{n_1}, \text{ for moist air.}$$

[1] Das dynamische Princip. der Circulations bewegungen in der Atmosphäre. Meteorol Zeit. Marz 1900 und April 1900. Translation. WEATHER REVIEW, October, 1900.

[2] Der räumliche Gradient, M. Möller. Meteorol Zeit. June, 1900.

[3] Ueber die Verwendung von Prof. V. Bjerknes' Theorie der Wirbelbewegungen in Gasen und Flüssigkeiten. Königl. Schwed. Ak. der Wiss. January, 1900.

[4] Räumlicher Gradient und Circulation. Von V. Bjerknes. Meteorol. Zeits. November, 1900.

It will be observed that Sandström seems to have omitted the following small variations depending upon gravity,

$$\frac{1}{n_1} = (1+\gamma)\,(1+\frac{h+h_o}{R}\Big).$$

If we make the following changes in notation Sandström's formulæ become the same as those of the Standard system:

	Sandström.	Bigelow.
Pressure,	p.	P.
Temperature,	t.	t.
Relative humidity,	r.	$R.H.$
Vapor tension,	f.	e (t and $g = 980.6$).
Coef. of expansion,	a.	$a = .00367$.
Normal density,	c.	ρ_o ($t = 0, B_s = 760$).
Other density,	q.	ρ ($B, t, R.H.$, as assigned).

By computing and plotting the lines of equal volume $v = \frac{1}{\rho}$ on the coordinates of temperature and logarithm of pressure, we have such diagonals as appear on the scheme of fig. 1 which is not drawn to scale. Taking such a circuit as is indicated by $B_o\ v_o\ B\ v$, Bjerknes has shown that the line integral of the circulation is $A = \frac{dC}{dt} = (P - P_o)\ (v - v_o)$, which is the work done in moving the unit mass once around the circuit. For, a certain amount of work is expended against gravity in raising the unit mass from q_1 to q_2 along the line of equal density ρ_o, no work is done in moving it along the isobaric surface B from q_2 to q_3, but work is gained in the fall of the mass from B to B_o along the line ρ from q_3 to q_4, and none in moving it along the surface B_o from q_4 to q_1. The sum of the work along the lines $\frac{1}{\rho_o}$ and $\frac{1}{\rho}$ taken algebraically, if not equal to zero is equivalent to 4π I, a well-known theorem in dynamics, since it is the curl of the total current through the circuit. The only objection to this procedure is the practical difficulty involved in computing the values of ρ_o and ρ in the free atmosphere. For this purpose it is proposed to utilize actual measures as provided by kite and balloon ascensions, where the observations are to be taken *in situ*, and then combined through computations as illustrated by Sandström.

The purpose of this paper is to show that the same result can be obtained in a different way, and that this involves only such observations on the velocities of the motions of the air as may be secured by the ordinary triangulations with two theodolites placed at the extremities of a base line, as was done in making the international cloud observations in 1896–1897.

The definition of work is that it is the product of the force of acceleration and the distance through which it acts. Thus, if the gradient pressure force is $-\frac{1}{\rho}\frac{\partial P}{\partial x}$, and the distance ∂x, the work $= -\frac{1}{\rho}\frac{\partial P}{\partial x}.\partial x = -\frac{\partial P}{\rho}$. If this is computed along three rectangular axes joining the points $x_o\ y_o\ z_o$ and $x\ y\ z$, the sum is the work required to move a unit mass from the first to the second point. Now, the work, as derived from the equations of motion, involving acceleration of velocity, centrifugal forces, and deflecting forces on the rotating earth, is given in three coordinates by formula 210 as follows:

$$-\frac{\partial P}{\rho} = \frac{dx}{dt}.\partial u - 2n\cos\theta\, v\,.\partial x - \frac{\cot\theta}{r}v^2\,.\partial x + \frac{1}{r}u\,.\,w\,.\,\partial x.$$

$$-\frac{\partial P}{\rho} = \frac{dy}{dt}.\partial v + 2n\sin\theta\, w\,.\partial y + \frac{1}{r}v\,.\,w\,.\,\partial y + 2n\cos\theta\, u\,.\partial y + \frac{\cot\theta}{r}u\,v\,.\partial y.$$

$$-\frac{\partial P}{\rho} = \frac{dz}{dt}.\partial w - 2n\sin\theta\, v\,.\partial z - \frac{1}{r}v^2\,.\partial z - \frac{1}{r}u^2\partial z + g\partial z.$$

This is derived from 155 by making the substitutions indicated in the following pages up to 505. If we introduce

202, $\qquad v\partial x = u\partial y, \quad w\partial x = u\partial z, \quad w\partial y = v\partial z,$

and take the sum of the partial differentials, the result is

203, $\qquad -\frac{\partial P}{\rho} = u\partial u + v\partial v + w\partial w + g\partial z.$

We have for moist air mixed with dry air, 47a,

$$\frac{1}{\rho} = \frac{1}{\rho_o}\frac{P_o(1+at)\,(1+\beta)}{P} = \frac{1}{aP}.$$

For common logarithms,

$$\frac{1}{a} = \frac{P_o(1+at)\,(1+\beta)}{\rho_o M}.$$

$$= g_o\frac{\rho_m\ B_s\ (1+at)\,(1+\beta)}{\rho_o M} = \frac{(1+at)\,(1+\beta)}{a_o}$$

$$\frac{1}{a_o} = \frac{78359}{M} = 180431 = Kg_o = 18400 \times 9.806.$$

$$= g_o\frac{l}{M} = \frac{l}{M}g\,(1+\gamma)\,(1+\delta).\quad \text{Hence,}$$

$$\frac{1}{a} = gK(1+at)\,(1+\beta)\,(1+\gamma)\,(1+\delta).$$

Furthermore, we have

$$\log\frac{P_o}{P} = (1+\gamma)\frac{B_o}{B}. \qquad 57$$

Compare the general formula 58. Now, integrating 203 along a given line, where ρ is constant, we obtain,

$$-\int\frac{\partial P}{\rho} = -\frac{1}{a}\int\frac{\partial P}{P} = -\frac{\log P}{a}$$

$$= \frac{u^2}{2} + \frac{v^2}{2} + \frac{w^2}{2} + gz = \frac{q^2}{2} + gz.$$

Placing the limits at the isobars P and P_o there results along ρ_o, by distinguishing the points as q_1 and q_2,

$$-\int\frac{dP}{\rho_o} = -\frac{(P-P_o)}{\rho_o} = \frac{\log P_o - \log P}{a}$$

$$= \tfrac{1}{2}(q_2^2 - q_1^2) + g(z_2 - z_1).$$

This is the work done in moving the unit mass from q_1 to q_2. If we integrate similarly along the line ρ, we have

$$-\frac{(P-P_o)}{\rho} = \tfrac{1}{2}(q_3^2 - q_4^2) + g(z_3 - z_4).$$

If the integral sum is taken algebraically around the circuit in one direction, since the terms along the isobars having $(P - P) = 0$ and $(P_o - P_o) = 0$ of course disappear, there remains,

$$(P-P_o)\Big(\frac{1}{\rho} - \frac{1}{\rho_o}\Big) = (P-P_o)\,(v-v_o)$$

$$= (\log P_o - \log P)\,\Big(\frac{1}{a_1} - \frac{1}{a_2}\Big)$$

$$= \tfrac{1}{2}(q_3^2 + q_2^2 - q_4^2 - q_1^2) + g(z_3 + z_2 - z_4 - z_1).$$

Hence, we see that the Bjerknes theorem is reproduced, and that it may be expressed as the product of the difference of two pressures multiplied by the difference of the two volumes; or

as the product of the difference of two logarithms by the difference of the reciprocal of two coefficients; or as one-half the sum of the squares of the velocities at two points on the upper isobar, minus the sum of the squares of the velocities at two points on the lower isobar, added to the product of gravity by the sum of the heights of the same two points on the upper isobar, minus the heights of the two points on the lower isobar. The pressures P, P_o can be changed into the barometric pressures B, B_o by adding the factor $(1+\eta)$.

We see then that instead of computing the work integral around the circuit by means of the densities as measured by observations *in situ*, the velocities measured by theodolites stationed on the ground are a perfect substitute, and the mode of obtaining the velocities of the motion of the air at four points by triangulation is much easier than by ascensions of any kind. Furthermore, it is not necessary that the upper and the lower point-pairs should lie on the same isobar, for it is equally correct to use any four points ,and indeed any number of points joined together in a chain around a circuit in the atmosphere, by combining the velocities and the gravity terms in algebraic succession. Attention is called to the fact that the recent Report of the Chief of the Weather Bureau on the International Cloud Observations contains a large amount of material in proper form for such computations. The twenty subareas of the normal cyclones and anticyclones give at the heights of the designated cloud strata the velocities of motion carefully determined. They are also arranged in vertical lines over each subarea, so that there are 20 vertical gagings through each cyclone and anticyclone, respectively. Also, the data for computing the specific volumes are given in the same connection, and can be employed in check computations. We hope to be able to pay some further attention to the development of this interesting subject.

It is noted that in the course of the integration all the terms depending upon deflecting and centrifugal forces have dropped out. Bjerknes properly stated that these could be neglected. In the final equation, if the integration is around a circuit, the terms in gz will disappear because the sum of the (z) is zero, the involved variations of the products (gz) being too small to have appreciable value. Finally, by 389*a*, page 588, it is seen that the temperature gradients involve the form $(z-z_o)$ as a factor, so that in a circuit this correction practically disappears. There remains only the friction kq, and as this is an insignificant quantity in the air above a thin surface skin, say 500 feet deep, but little will be derived from this term to modify the circulation. On the other hand, turbulent motions and the interplay of mixing minor vortices in all stages of formation may actually introduce a term of significance. These questions, and many more, can be discussed to advantage by the theory of closed circuits. When the integration is not around a circuit the gravity temperature and friction terms must enter the equations. It is also to be remarked that reductions to sea level, or from one height to another in the free air, are not complete when referred to the static term gz alone, as is commonly done in barometry, but the dynamic term $\frac{1}{2}q^2$ should also enter. The United States Weather Bureau is engaged in reconstructing its entire series of barometric observations, taken during the past thirty years, and they are to be reduced to a homogeneous system. It can now be stated that there still remain some small residuals, which may be due to local variations of gravity, or to local variations of the assumed mean temperature of the air column, or to local changes in a constant used for the plateau reductions, or finally they may be due in part to the swirl of local circulations or eddies, all of which the theory under discussion may be used in elucidating. It is an important advance in meteorology to have the problem, as stated by Prof. V. Bjerknes and Dr. Sandström, brought to the attention of students of the dynamics of the atmosphere.

THE PEOPLE OF MARS.

By CHARLES FITZHUGH TALMAN, U. S. Weather Bureau.

The climates of other planets than our own form a subject which will perhaps largely occupy the attention of future meteorologists who, with more efficient means of observation than we now possess, may find in the phenomena of the planetary atmospheres important aid in the elucidation of many obscure phases of their science.

Already, in the study of the planet Mars, certain interesting and seemingly anomalous atmospheric conditions have been observed. The insolation of this planet, per unit of area, is less than half that of the earth. This circumstance would seem to imply a rigorous climate, yet it is almost certain that the average temperature at the Martian surface is somewhat higher than that of our own globe; for otherwise we can hardly account for the small extent of the polar snow-caps which are so important a feature of the planet's topography.

All the evidence points to a similarity between the terrestrial and Martian climates, and this fact leads up to the perennial topic of the planet's inhabitants. Never does there occur a favorable opposition of Mars, that the newspapers do not seize the opportunity to publish more or less fantastic dissertations on this inexhaustible subject, in which the sometimes relatively sober and moderate intention of the writers is completely misinterpreted by extravagant pictures, purporting to be faithful portrayals of the Martians and of the conditions of life on their planet. At the same time hare-brained speculators spring up everywhere prepared to show us exactly how to telegraph across the abyss of space and communicate with the inhabitants of our sister world.

It is strange that no one has ever pointed out how unphilosophical, from a biological point of view, is the question, "Are there people on Mars?"

In the writings of many latter-day litterateurs and not a few professed scientists we find glib references to the people of this or that planet, and the use of these words implies the assumption that life, from its necessarily simple beginnings, has, in each world where it exists, ultimately developed one and only one species more or less like the human race, and clearly differentiated from and superior to all the other species produced in the same world. But nothing that we know of the evolutionary process warrants such an assumption.

The imaginable forms which living matter may assume are infinitely diverse. Look forth upon the myriad species of organic beings—plants and animals—which our own world contains. Where among them all can you find an organism, other than man, which, if placed upon Mars, would be intellectually capable of communicating with us? What success would we have in attempting to telegraph to a race of horses or guinea pigs, for example?

On our own planet the development of life apparently entered, at an early stage, upon two diverse roads. The forms subsequently evolved, though probably of common ancestry, are nevertheless clearly and naturally divided into two great kingdoms, the animal and the vegetal. But there is no reason for supposing that the course of events has been the same in other worlds than ours. For example, it may be that on Mars plant life only exists. Now, suppose that, as the speculators on this subject commonly assume, Mars has supported life longer than the earth. In such a case the plant forms would presumably have reached a high stage of development; plants would there exist compared with which our highest plants, such as daisies and asters, are simple and rudimentary. Nevertheless, it is not conceivable that any plant, however high in the scale, could hold communication with the human race.

However, I think it is most reasonable to suppose that, if

life has been produced at all upon other planets than our own, it has assumed forms of which we know nothing; forms which may be neither animal nor vegetal, which transcend our experience, and of which we are therefore quite unable to conceive. Given life, plastic and protean, and the laws of probabilities, and such a result would seem to follow as a matter of course.

Even could we actually perform the journey to Mars, it is not likely that we would be able to communicate with its inhabitants, and if we found existing there a great number of life forms we would probably have difficulty in deciding to which of them, if any, the designation people should be applied.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made partly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological Observations at Honolulu, December, 1900.

The station is at 21° 18′ N., 157° 50′ W.

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m., Greenwich time, or 2.29 a. m., Honolulu time.									
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		Total rainfall at 9 a. m., local time.
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.89	73	71	80	69	66.0	73	ne.	2	1	29.97	29.85	0.02
2	29.86	70	68	80	71	68.0	79	e-ne.	2	7	29.95	29.84	0.00
3	29.89	67	65	80	69	66.3	75	ne.	3-1	5-2	29.91	29.83	0.00
4	29.88	66	64	80	67	65.7	79	ne.	1	1	29.95	29.83	0.00
5	29.91	73	67.5	81	65	66.5	80	sw-n.	1-0	1-3	29.93	29.83	0.08
6	29.97	72	68	78	71	66.5	78	nne-ne.	3	5	30.00	29.90	0.63
7	29.99	72	67	77	70	66.7	81	ne.	3	6	30.02	29.95	0.27
8	29.98	68	61.5	77	70	63.0	72	nne.	3	10-2	30.03	29.92	0.01
9	29.96	70	64.5	78	62	63.5	77	nne.	1	1-7	29.98	29.86	0.00
10	29.94	66	65	76	69	63.3	75	nne.	3-0	3-6	29.98	29.89	0.09
11	29.99	69	67.5	74	66	65.5	87	nne.	2	8	30.00	29.91	0.09
12	30.02	73	67	78	69	66.0	80	nne.	2	7	30.04	29.97	0.03
13	30.04	74	68	79	71	63.7	68	ne.	3	5	30.09	30.03	0.00
14	30.04	73	66	79	73	65.3	70	ne.	2-4	5	30.09	29.99	0.00
15	30.09	74	66.5	79	73	64.0	68	ne.	2-0	2	30.10	30.01	0.00
16	30.07	70	67	80	67	63.7	67	ne.	3-0	3-6	30.13	30.05	0.00
17	30.02	62	60.5	80	69	65.5	77	w-n.	1-0	4-1	30.09	29.99	0.00
18	29.95	61	60.5	79	62	60.5	75	n.	2	1	30.02	29.90	0.00
19	29.95	67	66	78	60	64.3	81	se-sw.	1-0	3	29.98	29.90	0.00
20	30.04	67	64.5	79	67	65.5	77	sw-w.	1-0	2-7	30.07	30.00	0.00
21	30.05	64	62.5	82	66	65.3	79	ne-e.	1-0	2-7	30.07	30.00	0.00
22	29.95	69	67	78	64	63.7	76	ne.	1-0	0-4-0	30.06	29.93	0.02
23	29.89	64	63.5	79	65	65.5	76	nne.	1	6-1-8	29.98	29.86	0.01
24	29.87	73	68.5	79	64	66.3	84	e-sw.	1-0	1-8	29.91	29.83	0.16
25	29.92	69	67	80	70	66.7	77	sw.	3-0	5	29.94	29.84	0.26
26	29.94	70	64.5	78	66	66.5	81	wsw.	1-0	3	29.98	29.90	0.00
27	29.93	69	60.5	75	70	61.7	71	nne.	3-6	2-6	30.01	29.92	0.60
28	29.93	64	57	75	68	56.3	60	nne.	5-4	4-0	29.99	29.89	0.00
29	29.99	59	56	72	62	53.3	61	nne.	3-1	3-0	30.01	29.91	0.00
30	29.98	56	54	73	58	53.7	64	nne.	1-3	6-0	30.06	29.97	0.00
31	29.94	64	58	74	55	53.7	67	nne.	0-3	1	30.05	29.93	0.00
Sums.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.67
Means.	29.963	67.8	64.3	77.7	66.4	63.5	74.5	.....	1.7	4.2	30.016	29.917	.....
Departure.	—.005	.....	.....	.....	...	+0.5	—0.3	.....	.....	.....	.....	.....	—3.00

Mean temperature for December, 1900 (6+2+9) ÷ 3 = 71.6; normal is 71.5. Mean pressure for December, 1900 (9+3) ÷ 2 = 29.965; normal is 29.970.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡These values are the means of (6+9+2+9) ÷ 4. §Beaufort scale.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for December, 1900.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	°*F.*	°*F.*	°*F.*	%	*Inch.*		
Chihuahua	4,633	25.48	61.7	26.8	44.2	60	0.02	ne.	.....
Leon (Guanajuato)	5,934	24.33	72.3	39.4	54.5	79	2.06	ssw.	sw.
Mazatlan	25	29.96	88.8	60.3	73.2	65	0.18	nw.	.....
Mexico (Obs. Cent.)	7,472	23.09	69.8	41.0	52.3	74	4.50	n.	ne.
Morelia (Seminario)	6,401	24.00	70.7	41.0	52.5	81	3.15	sse.	sw.
Saltillo (Col. S. Juan)	5,399	24.81	69.8	33.8	51.8	82	2.38	s.	s.
San Luis Potosi	6,202	24.16	7[illegible].2	37.0	53.4	78	3.20	ne.	.....
Tampico	38	29.96	86.0	50.0	65.3	80	3.21	se.	.....
Zapotlan (Seminario)	5,078	25.13	75.9	46.4	59.9	74	3.89	sse.	sw.

MONTHLY STATEMENT OF AVERAGE WEATHER CONDITIONS FOR DECEMBER.

By Prof. E. B. GARRIOTT.

The following statements are based on average weather conditions for December, as determined by long series of observations. As the weather of any given December does not conform strictly to the average conditions the statements can not be considered as forecasts:

Settled weather prevails in the tropical regions of the Atlantic and Pacific oceans in December. In the middle latitudes of the North Atlantic, on an average, three storms of marked strength traverse the ocean from the American to the European coasts. These storms follow closely the paths of the transatlantic steamships, and usually occupy three to four days in the passage from Newfoundland to the British Isles. December is one of the months of minimum fog frequency along the transatlantic steamship routes, and icebergs are seldom seen over or near the Banks of Newfoundland.

The severer storms of December average about three a month over the Great Lakes and on the north Atlantic coast of the United States; about two a month on the middle Atlantic coast; and about one a month on the south Atlantic, Gulf, and middle and north Pacific coasts.

December is one of the months of maximum rainfall in the Pacific coast districts of the United States. It is also one of the wet months in the middle and northern Plateau districts. In Arizona and New Mexico the winter precipitation is much lighter than that of the summer months. On the eastern slope of the Rocky Mountains and in the Missouri and upper Mississippi valleys December is one of the driest months of the year. In the Gulf districts the rainfall averages less than that of the summer and fall months. In the Atlantic coast States, the Lake region, and the Ohio Valley the average precipitation for the different months and seasons does not vary greatly.

In December frost may occur in any part of the United States except the extreme southern portion of the Florida Peninsula. During December, January, and February, the trucking districts of the South Atlantic and Gulf States, and the orange groves of Florida and the Gulf coast districts, are

subject to damage by freezing weather. Severe freezes are not, however, of yearly occurrence in the districts named, but occur, on an average, about once in five years.

Heavy snowfalls in December are of rare occurrence in the United States.

PROF. M. H. YERBY.

By F. P. CHAFFEE, Section Director.

It is with deep regret that I announce the loss of a valuable cooperator in the work of the Weather Bureau by the death of Prof. M. H. Yerby, voluntary observer at Greensboro, Ala., on November 10, 1900, in the seventy-third year of his age.

Professor Yerby was born in Tuscaloosa County, Ala., June 19, 1828. His early life was spent on his father's farm. He graduated from the University of Alabama, and soon afterward adopted teaching as a profession, which he followed about forty-five years. In 1858 he moved to Greensboro, where he resided continuously during the remainder of his life. He was the voluntary observer at that place from January, 1888, up to the time that he was taken down with the brief illness which ended his life. There is not a single break in his very accurate meteorological record during nearly thirty years of work as a voluntary observer. His work will be of great value to the Bureau in determining the average climatic conditions of the locality in which he resided, and his fidelity to this work, which he assumed voluntarily and performed gratuitously, is indeed worthy of emulation.

Mr. W. E. W. Yerby, son of Professor Yerby, has kindly consented to continue the good work of his father in keeping up the voluntary record at Greensboro.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Naturwissenschaftliche Rundschau. Braunschweig. 15 *Jahrg.*

Angstrom, Knut. Intensität der Sonnenstrahlung in verschiedenen Höhen, nach Untersuchungen auf Tenerifa 1895 und 1896. P. 649.

Geographische Zeitschrift. Leipzig. 6 *Jahrg.*

Koeppen, W. Versuche einer Klassification der Klima, vorzugsweise nach ihren Beziehungen zur Pflanzenwelt. (Schluss.) P. 657.

Gaea. Leipzig. 37 *Jahrg.*

Klein, [H. J.] Die Erforschung der hohen Schichten der Atmosphäre und ihre Bedeutung. P. 11.

Weiler, W. Ueber Blitzableiter. P. 23.

Memoria della Soc. deg. Spettroscopisti Ital. Catania. Vol. 29.

Tacchini, P. ed Ricco, A. Eclisse totale di sole del 28 Maggio. 1900. P. 111.

Philosophical Magazine. London. Vol. 1. *6th Series.*

Barton, E. H. Refraction of Sound by Wind. P. 159.

Rayleigh, Lord. Spectroscopic Notes concerning the Gases of the Atmosphere. P. 100.

Archives des Sciences Physiques et Naturelles. Genève. Quatrième Période. Tome 10.

Tommasina, Thomas. Sur l'étude des orages lointains par l'électroradiophone. P. 513.

Jacquet. Nouvelles recherches sur l'action physiologique du climat d'altitude. P. 580.

Gautier, R. Résumé météorologique de l'année 1899 pour Genève et le grand Saint Bernard. V. Pluie et neige. P. 539.

Sarasin, Ed. Oscillations du lac des Quatres-Cantons. P. 600.

La Nature. Paris. 29*me année.*

Grafigny, H. de. La navigation aérienne en 1900. P. 103.

Meteorologische Zeitschrift. Wien. Heft 11.

Bjerknes, V. Räumlicher Gradient und Cirkulation. P. 481.

Wollny, E. Ueber den Einfluss der Pflanzendecken auf die Wasserführung der Flüsse. P. 491.

Muller, W. Ueber die Beobachtung von Irrlichtern. P. 505.

Polis, P. Das meteorologische Observatorium Aachen. P. 515.

—— Der Meteorologen-Kongress in Paris. P. 516.

H[ann], J. Die meteorologischen und erdmagnetischen Ergebnisse der antarktischen Epedition des Jahres 1899–1900. P. 519.

Arctowski, Henrik. Notiz über die während der Ueberwinterung der belgischen antarktischen Expedition beobachteten Südlichter. P. 522.

—— Zahl der Frosttage in Greenwich. P. 522.

Erzherzog Ferdinand IV. Meteorfall? P. 523.

Danckelman, v. Regenfall in Neu-Guinea. P. 523.

Rotch, L. Ballon und Drache. P. 524.

Henry, A. J. Tod durch Blitzschlag im Jahre 1899.

Scottish Geographical Magazine. Edinburgh. Vol. 17..

Cornish, Vaughan. Formation of Wave Surfaces in Sand. P. 1.

Ciel et Terre. Bruxelles. 21*me année.*

Arctowski, H. Aurore australe mouvementée. P. 501.

Marchand, E. et Fabre, L. A. L'action de la rotation terrestre sur l'orientation des cours d'eau. P. 506.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 131.

Chauveau, A. B. Sur la variation diurne de l'électricité atmosphérique. P. 1298.

Science. New York. N. S. Vol. 13.

T[hurston], R. H. Frictional Effect of Railway Trains on the Air. P. 115.

Nature. London. Vol. 63.

Wood, R. W. Artificial Representation of a Total Solar Eclipse. P. 250.

RECORDS BY THE KITE CORPS AT BAYONNE, N. J.

Communicated by Dr. W. H. MITCHELL, Secretary to the Corps.

Herewith we present our fourth semiannual tabulated record of temperatures obtained from thermometers carried up by the kites of our corps. These thermometer records are obtained at every ascension, no matter what other experiment we may have in view.

We now have the use of a building, 15 by 25 feet, in which we have established a station, and daily records are taken. We have quite a physical laboratory to assist us in our work.

All our field outfit is mounted, so that when at work we are so mobile that we frequently move our base several hundred feet, while our kites may be 2,000 feet high, to avoid the obstructions of buildings, trees, and telegraph lines occasioned by a change in wind direction after we have made an ascension.

Besides our meteorological records, the most interesting and attractive experiment of the past six months was made during ascension No. 136, when six pairs of carrier pigeons were released from a trap under the carrier. * * * These birds took instantaneous flight from an altitude of 800 feet for their home cote, holding the altitude at which released.

We have to obtain our essentials and apparatus slowly, being hampered by a lack of funds, but hope eventually to have a steam reel in service, when we will push for higher altitudes. At present we can not subject ourselves to the strain and labor of winding in the long lines that would be necessary to attain even 10,000 feet.

We invite correspondence with foreign stations on kite work, and will reciprocate favors and exchange results.

The reader will notice that the maximum and minimum temperatures attributed to certain ascensions (e. g., February 21, March 21, 24, 31, etc., as marked with a ‖) appear to be reversed in the columns as published. These are printed exactly as given in Mr. Mitchell's manuscript. As it appeared likely that these were cases in which the temperature at the reel or ground was lower than the temperature at the kite, the Editor inquired of Mr. Mitchell and received the following reply:

You are right in your surmise that the column of maximum temperatures is the temperature at the ground before the thermometer starts aloft; hence the fact that we placed the high reading in minimum column.

We have often found on coming down that both indices have moved on our Six's, showing that there were warmer currents of air aloft. Thus, e. g., we leave the earth with an earth temperature of 60°; go up, say, 1,200 feet; our reading on taking down might be, maximum 65°, minimum 52°; the duration of flight, say, from 8:25 to 9:15 p. m.; earth temperature at ending, say, 39°.

We may enter the warm current of air at an altitude of 500 feet and enter a colder one at 600 or 800, or we may get our minimum record up as far as 600 feet and stop in the warmer current at our highest altitude (1,200).

Thermometer ascensions made at Bergen Point, Bayonne, N. J., by Bayonne kite corps.

Number.	Ascension. Date.	Ascension. P. M. Began.	Ascension. P. M. Ended.	Kite record. Altitude.	Kite record. Temperature. Max.	Kite record. Temperature. Min.	Local conditions. Temperature. Beginning.	Local conditions. Temperature. Ending.	Local conditions. Barometer.	Local conditions. Hygroscope.	Local conditions. Wind.	Local conditions. Sky. Character	Local conditions. Sky. Remarks.	New York. Temperature. Beginning.	New York. Temperature. Ending.	New York. Wind at beginning of ascension. Direction.	New York. Wind at beginning of ascension. Velocity.	Average daily record furnished by the observer at Bergen Point, Bayonne, N. J.§ Same day.	Second day.	Third day.
1	2	3 H. M.	4 H. M.	5 Feet.	6 °	7 °	8 °	9 °	10 Ins.	11 %	12	13	14	15 °	16 °	17	18 Miles.	19 °	20 °	21 °
122	Jan. 3, 1900	8 30	9 45	755	22	18	.....	20	30.40	73	nw.	Clear.	.....	22	22	nw.	11	24.5	25.5	40
123	Jan. 6, 1900	8 45	10 00	542	36	30	.....	33	30.50	70	sw.	P cloudy.	Cumulus.	37	36	nw.	12	41	37	40.5
124	Jan. 8, 1900	8 55	10 30	2,350	27	10	.....	18	30.45	68	nw.	Clear.	Moonlight.	26	23	nw.	13	40.5	23.5	35.5
125	Jan. 9, 1900	8 25	9 50	1,854	28	19	.....	24	30.41	70	nw.	Clear.	Lunar halo, 6:30.	32	32	s.	12	23.5	35.5	30.5
126	Jan. 13, 1900	8 32	10 15	1,950	33	27	.....	30	30.15	72	.....	P. cloudy.	L. halo, 8; l. corona, 11.	33	32	sw.	4	31	33.5	37.5
127	Jan. 17, 1900	8 20	9 50	850	35	31	.....	33	30.60	83	se.	Cloudy.	Cumulus.	35	34	e.	16	37	37	44
128	Jan. 19, 1900	9 00	10 15	¶	48	46	.....	47	30.05	100	ne.	Cloudy.	Dense fog.	51	50	e.	9	44	50	34
129	Jan. 20, 1900	8 25	9 35	1,100	53	48	.....	50	29.35	98	sw.	Cloudy.	.....	54	52	sw.	14	50	34	40.5
130	Jan. 27, 1900	8 35	10 00	1,480	25‖	20	.....	27	30.30	79	nw.	Clear.	....	26	26	w.	4	22.5	32	23.5
131	Feb. 6, 1900	8 30	10 12	1,640	39	33	.....	36	30.15	72	sw.	Clear.	.....	41	40	nw.	12	35	35	40
132	Feb. 10, 1900	8 15	9 30	970	33	28	.....	31	30.30	93	ne.	Cloudy.	Lunar halo.	34	34	nw.	6	33	38	39
133	Feb. 12, 1900	2 50	4 00	950	40	36	....	39	30.22	100	e. by se.	Cloudy.	Mist.	41	41	ne.	12	39	50.5	35
134	Feb. 17, 1900	9 15	9 25	600	22	15	.....	18	29.77	96	ne.	Cloudy.	Snow.	24	23	n.	14	25.5	23	21
135	Feb. 21, 1900	8 45	10 30	1,150	38‖	42	.....	38	30.10	97	se.	Cloudy.	.....	39	38	ne.	16	31	52.5	38.5
136	Feb. 22, 1900	2 15	4 25	1,500	62	54	.....	60	29.30	90	sw.	P. cloudy.	3 pair U. S. Navy pigeons released.	50	49	nw.	10	52.5	38.5	41
137	Feb. 24, 1900	8 12	9 30	1,212*	47	38	.....	45	29.40	100	se.	Cloudy.	Rain, 8:45.	46	45	se.	13	41	13	17.5
138	Feb. 27, 1900	8 25	10 30	2,300	20	15	.....	18	30.75	70	nw.	Clear.	.....	17	18	nw.	9	13.5	26.5	47.5
139	Mar. 7, 1900	8 15	10 15	1,840	34	28	.....	31	30.45	60	nw.	Clear.	.....	39	37	nw.	14	40.5	32.5	38.5
a	.....†	8 40	9 00	1,000	.....	32	.....	32	.....	.....	.....	.....	Car ascension.	38	38	nw.	14	... ..	.....	.....
b	.....†	9 12	9 30	1,000	.....	30	.....	31	....	....	.....	.....	.....	38	37	nw.	26	.....	.....	.....
c	.....†	9 35	10 00	1,000	.....	30	.....	31	.....	....	.....	.....	.....	37	37	nw.	24	.....	.....	.....
140	Mar. 10, 1900	9 42	9 55	300	38	36	....	38	29.85	88	n. by w.	P. cloudy.	Cirrus upper, ne.	37	36	nw.	20	43 5	28.5	24
141	Mar. 17, 1900	8 30	10 35	1,906	18	12	.....	16	30.20	70	nw.	Clear.	....	16	14	ne.	32	22	23	40.5
142	Mar. 21, 1900	8 21	10 05	1,650	30‖	26	.....	30	30.20	68	w.	Clear.	....	32	31	nw.	12	32.5	37	44.5
143	Mar. 24, 1900	8 45	9 50	980	34‖	27	.....	35	30.10	78	nw.	Clear.	....	33	31	nw.	14	31.5	36	37
144	Mar. 31, 1900	8 33	10 25	850	37‖	39	.....	37	29.90	70	nw.	Clear.	.....	38	35	nw.	42	40	45	49.5
145	Apr. 3, 1900	8 45	10 00	870	44‖	47	. .....	45	29.96	88	sw.	Clear.	Moonlight.	45	43	nw.	22	45.5	43.5	44
146	Apr. 7, 1900	9 16	9 55	680	48	46	....	47	30.70	75	nw.	Clear.	Meteors.	53	50	nw.	24	52.5	50	40
147	Apr. 11, 1900	8 20	9 40	890	40	38	.....	39	30.30	97	ne.	P. cloudy.	Hail and rain, 10:26.	42	42	se	12	42	43.5	45
148	Apr. 13, 1900	8 35	10 05	1,160	39	32	.....	37	29.90	90	nw.	Cloudy.	.....	43	41	nw.	11	45	46	51.5
149	Apr. 14, 1900	9 05	9 48	1,009	40‖	42	.....	40	30.15	80	w. by s.	Clear.	Moonlight.	45	45	nw.	20	46	51.5	53
150	Apr. 18, 1900	8 35	10 12	963	59‖	64	.....	60	30.10	98	sw.	Cloudy.	.....	54	55	s.	25	58	66	60.5
151	May 2, 1900	8 49	10 30	1,780	50	48	. . ....	48	29.85	90	ne.	P. cloudy.	Cumulus	59	57	e.	12	57	66	54
152	May 4, 1900	8 45	10 40	1,155	49	40	.....	38	29.90	95	sw.	Cloudy.	.....	52	49	sw.	10	54	51	55.5
153	May 10, 1900	8 30	10 05	1,578	48	44	.....	46	30.10	70	nw.	Clear.	Moonlight, meteors.	49	48	n.	12	49	48	61
154	May 12, 1900	8 41	9 50	780	58	50	.....	56	30.10	78	sw.	P. cloudy	....	57	57	s.	18	61	70	76
155	May 15, 1900	8 30	10 15	970	79	75	.....	78	29.94	78	w.	Cloudy.	.....	82	74	nw.	22	79.5	70	59
156	May 18, 1900	8 45	9 55	950*	65	60	.....	64	29.75	100	s.	Rain.	....	67	65	s.	10	66	56.5	62
157	May 25, 1900	7 45	2 00‡	1,875	58	46	.....	52	30.25	80	ne.	P. cloudy.	.....	61	51	ne.	11	59	57	64.5
a	.....†	8 02	8 30	1,000	.....	56	.....	56	.....	.....	.....	.....	Car used.	60	59	ne.	22	.....	.....	.....
b	.....†	8 40	9 30	1,000	.....	54	.....	54	.....	....	.....	.....	.....	59	58	ne.	18	.....	.....	.....
c	.....†	9 37	10 30	1,000	.....	53	.....	54	.....	....	.....	.....	.....	58	57	ne.	23	.....	.....	.....
d	.....†	10 42	11 30	1,000	.....	53	.....	52	.....	....	.....	.....	.....	57	56	ne.	20	.....	.....	.....
e	May 25-26, 1900†	11 35	12 30‡	1,000	.....	52	.....	52	.....	....	.....	.....	.....	56	54	ne.	23	.....	.....	.....
f	May 26, 1900†	12 37‡	1 30‡	1,000	.....	48	.....	52	.....	....	.....	.....	.....	53	52	ne.	22	.....	.....	.....
158	May 28, 1900	9 15	10 30	853	50‖	53	.....	52	30.10	98	e.	Cloudy.	Cumulus.	58	58	n.	9	57	64.5	56.5
159	May 29, 1900	8 45	10 40	980	49‖	54	.....	51	30.35	70	w.	Clear.	.....	54	53	s.	9	55.5	61	75
160	May 30, 1900	3 16	5 20	960	76	72	.....	75	30.35	65	sw.	Clear.	Northeast aloft.	70	71	se.	10	61	75	74.5
161	June 2, 1900	8 30	10 40	1,203	66	64	.....	65	29.90	96	sw.	Cloudy.	North-northwest aloft.	69	68	sw.	16	74.5	74.5	64.2
162	June 5, 1900	4 30*	5 45*	985*	50	48	.....	51	30.18	68	nw.	Clear.	.....	57	56	nw.	5	64	73	64.5
163	June 12, 1900	8 15	9 45	1,349	69	63	.....	67	30.15	93	se.	Cloudy.	Upper northeast.	76	70	se.	12	76.5	67.5	77.5
164	June 16, 1900	9 35	10 30	1,158	65	58	.....	63	30.07	90	sw.	Cloudy.	....	68	65	w.	6	68	60	64
165	June 23, 1900	8 50	9 26	600*	72	66	.....	69	30.00	68	sw.	P. cloudy.	Moonlight.	63	63	s.	9	71.5	70.5	82.5
166	June 29, 1900	8 30	9 00	230*	76	72	.....	75	29.70	97	sw.	P. cloudy.	Hazy.	83	83	sw.	22	76	70	69.5
167	June 30, 1900	6 10	7 00	600*	75	70	.....	73	.....	...	nw.	Clear	At Midland Beach, S. I.	74	72	nw.	25	70	69.5	70.5

* Ascensions marked thus * cord was used; piano wire used at all others. † Second thermometer under transit car taken down for reading hourly. ‡ A. M. of the 26th. § Mr. Willard W. Hotchkin. ‖ Cases where the minimum temperature occurs near the ground. ¶ Approximate, 0.35 of a mile of wire out as shown by cyclometer on reel. * This ascension began at 4:30 a. m. of the 5th.

NOTES BY THE EDITOR.

WEATHER FORECASTS IN MEXICO.

By a recent arrangement between the Director of Federal Telegraphs in Mexico, Señor Camilo A. Gonzales, and the Chief of the United States Weather Bureau, the latter has authorized Dr. I. M. Cline, Forecast Official at Galveston, Tex., to telegraph daily the location of the centers of the highest and lowest pressures in the neighborhood of the Rocky Mountain region in addition to the reports from stations received in accordance with previous agreements. This extension of the international work went into effect December 12, and Señor Gonzales writes that he is thus able to forsee the occurrence of northers on the Gulf one or two days in advance.

It may be of some historical interest to add that in the autumn of 1871 the Editor was able to point out the fact that the origin and character of the northers of Texas and the Gulf, about which much had been written by American students, had been made plain by the study of the United States Daily Weather Map; that, in fact, they represented simply the southward underflow of a thin layer of cold air which started as a cold wave or blizzard on our northern frontier;

that, furthermore, when these northerly winds reached the Gulf coast of Texas, the resistances of the land surface being succeeded by the lesser resistances of the waters of the Gulf, they blow with greatly increased force; that, furthermore, this cold air piling up against the precipitous coast of the Gulf of Campeche must give rise to cloudy and, perhaps, rainy weather, and the development of low pressures and cyclonic winds, such that storm centers would start thence and move northeastward toward our Gulf States. The general mechanism of this process is partly exemplified in the MONTHLY WEATHER REVIEW for 1893, pp. 226 and 363, and Chart I for December, 1893.

METEOROLOGY IN COSTA RICA.

The Chief of Bureau is much pleased to learn that after an interregnum of over a year the Government of Costa Rica has taken favorable action with regard to the famous Instituto Fisico-Geografico, and on September 1, 1900, reestablished Prof. H. Pittier as director of that institution, which he founded and conducted for so many years in the interest of all those branches of science and education that constitute the foundations of national prosperity. During the years 1899 and 1900 Professor Pittier was located on the Atlantic coast of Costa Rica, which is very unhealthy as compared with the Pacific coast and the interior, but his return to the good climate of San Jose will, it is hoped, gradually free him from the effects of the pernicious fevers and its resulting mental depression. The printing of the annals, and especially the bulletin of occasional papers, will be resumed at once. Our readers will be pleased to know that a monthly résumé of the conditions in Costa Rica will be communicated promptly for publication in each number of the MONTHLY WEATHER REVIEW. We hope that eventually it may be convenient to publish similar summaries for many other states in the Western Hemisphere.

It is greatly to be hoped that the system of rainfall or climatic stations in Costa Rica may be strengthened by the establishment of new ones in unfrequented localities, and especially by the inauguration of meteorological stations of the first order at Port Limon, on the Caribbean coast, and at some point on the Pacific coast, cooperating with the central station at San Jose, which represents the highlands of the southwestern slope of the central chain of mountains between which and the central chain of Nicaragua lies the valley containing Lake Nicaragua.

MICRO-PHOTOGRAPHS OF SNOW CRYSTALS.

According to an article in the Proceedings of the American Academy, Boston, Mass., April 13, 1898, page 431, by Dr. J. E. Wolff, the collection of about 400 of the most interesting micro-photographs of snow crystals made during the years, 1870–1895, by Mr. W. A. Bentley, of Nashville, Vt., has been acquired at a nominal cost by the Harvard Mineralogical Museum:

The scientific value of the collection is enhanced by Mr. Bentley's notes, and by the meteorological observations made by himself at the time that many of the sets from individual storms were obtained, including date, temperature, snowfall, condition of the clouds, direction and force of the wind, and sometimes notes as to the general character of the snow crystals as the storm progressed.

The magnifications range from 52 to 31 diameters, and are evidently much higher than those of previous collections. The same general types of crystals noticed by previous observers recur here, such as the star form, star form with solid nucleus, and tabular form, while the columnar form (hexagonal prism and base) is rare, and the hexagonal pyramid is not seen. Variations of skeleton growth of hexagonal plates comprising the base and prism of the first order, predominate; less commonly the intermediate axes are visible by lines of growth or air inclusions, and rarely a triangular development suggests rhombohedral symmetry. The presence of the varied markings due to inclusions of air is much more prominent in these than any as yet published, owing to the higher magnification and the superb technique of the photographs. Mr. Bentley also confirms the previous observation, that large stellate crystals are more common at the higher temperatures and the tabular ones at the lower.

Some photographs of frost crystallizations are included.

This large and perfect collection may justly be called a monument to the patience, skill, and enthusiasm of the maker.

In A Study of Snow Crystals, recently published in Appleton's Popular Science Monthly, (May, 1898, pp. 75–82), by W. A. Bentley and G. H. Perkins, the authors give further account of this collection with a reproduction of 27 examples.

The study of the forms of snow crystals has been a favorite subject with many physicists and meteorologists. Prof. Dr. G. Hellmann published in 1893 a little work entitled Schnee Krystalle, in which he gives a complete bibliography of the subject and a sketch of the progress of our knowledge, and copies very many diagrams from the older writers: Olaus Magnus, 1555; Descartes, 1637; E. Bartholinus, 1660; R. Hooke, 1665, who first used the magnifying glass and gives more than a hundred forms; F. Martens, 1675, who describes how from a little drop like a grain of sand the crystal grows by accessions from the surrounding fog or cloud until it becomes a hexagonal disk, transparent as glass, and so on, step by step, atom by atom is frozen on to the corners of the disk until it becomes a perfect star—Martens first distinguishes the forms of crystals in their connection with the prevailing weather, as observed by him at Spitzbergen; D. Rossetti, 1681, who distinguishes 6 types among the 60 different forms of snow—some of these types he subdivides into varieties, especially the rosette type, which includes 8 varieties. From this date on the number of publications becomes numerous; we may mention especially the great work of Jan Engelmann, who gives copper plates of 420 forms, although some of these must be considered very doubtful; two editions of this book were published, 1747 and 1771. The first person to form snow crystals artificially was Johann Carl Wilcke, of Sweden, who published two memoirs, 1761 and 1769, in the Transactions of the Royal Academy of Sciences at Stockholm. In 1820, the famous English navigator, Captain William Scoresby, Jr., published 96 snow figures, which have been widely reproduced in works on physics and meteorology. He distinguishes 5 genera, and under these 7 species and many varieties, some of them very rare indeed, near the surface of the earth, but probably more frequent in the upper regions; his 5 varieties have been widely accepted in descriptions of snowflakes, viz: (1) thin plates; (2) flat or spherical nuclei with branches in different planes; (3) fine spiculæ or six-sided prisms; (4) hexagonal prisms; (5) spiculæ having one or both extremities affixed to the center of a lamellar crystal. He also studied the relation of these forms to the weather and the temperature, but subsequently Karl Fritsch, 1853, showed that such relations are quite questionable, and the same result is also arrived at by James Glaisher. The latter observer, 1855, published plates containing 151 snow crystals, most of which are idealized pictures more delicate and symmetrical than is ever found in nature. It was the study of Glaisher's work that led Dr. Hellmann to pursue his investigations and, eventually, to apply micro-photography to the preservation of these fleeting forms. We ought, perhaps, to add that, among American observers, one should be put on record, Mrs. F. E. Chickering, of Portland, Me., who published a work anonymously entitled Cloud Crystals, A Snowflake Album, New York, D. Appleton & Co., 1864, reproducing on 27 plates original drawings, made between 1857 and 1863, of 189 forms observed at Portland, Me. This work contains also interesting communications on this subject by Prof. Louis Agassiz,

Cambridge, and Dr. Charles Smallwood, of Montreal. Among other items, Mrs. Chickering notes that twice she has observed the rare forms of hexagonal plates and hexagonal axles or prisms joined together in various combinations, like wheels and axles. Some of her figures were copied while in a deliquescent state, and some of her forms would, she says, be probably rejected by science as being in a transition state, but, as she correctly remarks, even in their transitions they are as much under law as when fixed. Unfortunately the dates and general weather conditions are not fully given in this volume.

All preceding work was done with the hand, aided by the microscope, but Professor Hellmann reproduces the microphotographs taken by Dr. Neuhauss at Berlin, in 1892–3, at the request of Dr. Hellmann. These pictures show the immense variety of types and variations under the types that occur in nature, as well as the great irregularity or departure from ideal forms sketched by previous observers. The angles 60° are preserved everywhere, but the combinations of parts are innumerable. Hellmann notices many peculiarities in the crystals from a crystallographer's point of view. With regard to the structure of the crystal, he finds as the most remarkable point the fact that the principal and subordinate rays are hollow capillary tubes. This fact had been known hitherto in only one special form of snow crystal, but the microphotograph shows that it exists everywhere. After the publication of a notice of Hellmann's work, other works were published confirming this structure, such as that of G. Nordenskiold, in Stockholm, published by the geological society in that city, and he also recognizes it in the careful drawings published by Rossetti in 1681. Hellmann finds that the purely star-formed snow crystals on the average are larger than those that have the shape of 6-sided plates, in the ratio of 2.8 to 1.9, as deduced from his early observations, and in the ratio of 2.3 to 1.3 from the micro-photographs. As regards the connection with temperature, Scoresby showed that crystals were more delicate and thinner and, in general, smaller as the cold increased. Hellmann finds that at —10° C. they are but one-third the size of those at —2° C. The microphotographs show the following mean diameters as the average of 6 to 10 cases: 3.4 milimeters at —6° C.; 2.2 mm. at —8° C.; 1.2 mm. at —12° C. He notes that the diminution in the weight of aqueous vapor per cubic meter in saturated air proceeds in very much the same ratio, viz: 3.2 grams for —6° C.; 2.7 grams at —8° C.; 2.0 grams at —12° C., and —0.5 grams at —30° C. The number of cases of occurrence of the different types of crystals also depends upon temperature, but the connection is not yet at all certainly made out; nevertheless the prevailing types occur in the following relative frequencies:

Relative frequency of snow crystals.

Forms of crystals.	Temperature.	
	—6° to —7.5°	—9° to —12.5°
	Per cent.	*Per cent.*
1. Stars with rays	52	24
2. Stars with flat expansions	22	19
3. Flat plates	26	57

From this we may conclude that the frequency of the flat forms increases, and that of the stellate forms diminishes with diminishing temperature, while the intermediate form, 2, occurs with equal frequency.

Hellmann finds the following classification adapted to his own observations. Type 1, lamellar snow crystals subdivided into (a) stars with rays; (b) flat plates, and (c) combinations of (a) and (b). Type 2, columnar snow crystals subdivided into (a) prisms; (b) pyramids and (c) combinations of (a) and (b). The type 1 is that usually observed both in temperate and polar regions.

Soon after the publication of Hellmann's work, in 1893, he discovered that not only Nordenskiold, at Stockholm, but also A. A. Sigson in Rybinsk, Russia, had been making microphotographs, some of which Hellmann reproduces in the Meteorologische Zeitschrift, 1894, p. 281, as these were the largest and most perfect yet attained. If to these three European collections we add the still larger collection made by W. A. Bentley during the years 1870–1895, it would seem that we have material for a very complete study of the forms and methods of formation of the snow crystal. But at present there does not seem to be much prospect of deriving from this study any additional knowledge of the temperature, moisture, and pressure prevailing when they are formed. It seems to the Editor much more likely that the small amounts of other gases and vapors occasionally present in the atmosphere, or the nature of the nucleii around which the crystals form, or the transitions through which they pass as they recrystalize while descending to the earth, may have a greater influence on their forms than pressure, moisture, and temperature.

BOMBARDING HAIL CLOUDS.

In answer to numerous inquiries about shooting at hail clouds for the purpose of dispersing them, the Editor would state that although statistics show that during the past year 15,000 shooting stations were established in Italy and a very large number in southern France and Austria, yet there is no evidence whatever that the shooting done by these stations has had any effect whatever upon the hailstorms or the hail. Generally the quantity of powder used is so small that the vortex rings are not able to ascend farther upward than 1,000 feet. They do not, therefore, reach the clouds; and if any effect could be produced upon the hail, it could only be by virtue of the noise or the dust, and these are far less than those made by Dyrenforth in his experiments with dynamite in 1892. The very sensible report of the director of the agricultural societies of the southeast of France says:

> We cannot conclude that the use of cannon will always afford complete protection, but it is undeniable that the results obtained are very interesting.

The recent congress of hail-shooters at Padua (25–29th November, 1900), could only conclude that we are in the midst of an extensive experiment, and that several years' work will be required in order to ascertain the true effect of the cannonading.

In some parts of France for several centuries it has been the custom to ring the church bells when a hailstorm is approaching. The modern newspaper writer guesses that the people do this by reason of their belief in the efficacy of the sound of the bell; but the historical fact is that this was originally simply an invitation to all good churchmen to unite in prayer for deliverance.

There is no doubt that the cannonading is believed to be effectual by the farmers who do the work; otherwise, they would hardly continue the labor and expense; and yet we must remember that waves of irrational enthusiasm sometimes sweep over a community only to be regretted in subsequent years, when a calmer judgment has come to prevail. The fact that 10,000 or 20,000 shooting stations have been established is of itself no argument as to the efficacy of the process. One might as well argue that the moon really affects the weather because a million people believe it, and can prove it—to their own satisfaction. A knowledge of the exact truth on any question of natural science is not easily attained, else the world would long since have progressed far beyond its present status in knowledge and civilization. The

most common errors among mankind are those that are based upon fallacies in reasoning rather than errors in observation. Thus, in the present case, we have innumerable reports to the effect that "a black cloud was seen approaching, cannon were fired, and the cloud passed over without hail," or "it passed to one side and the hail did not fall on the protected vineyard," or "it advanced to the edge of the vineyard and there the hail ceased" or "the cloud broke in two, passing to the right and the left, leaving the sky cloudless over the cannon." Now all these are quite common cloud and storm phenomena; they will happen oftentimes without any cannonading. The best friends of the Stiger or Italian method of annihilating hailstorms have recently confessed that the method is still in its infancy or experimental stage and that it is still necessary to investigate and demonstrate its value.

It is not yet time to say with an American writer—

> The cannonading does seem to have some effect in the way of changing hail to rain, and though the exact measure of that effect is still a matter of dispute, chiefly among those who, like the scientific paper mentioned, do more theorizing than observing, yet the owners of the vineyards are convinced that the protection secured is worth much more than it costs.

As to theorizing, those who are best acquainted with the true scientific man know that he is wholly devoted to observed facts, to the recognized laws of nature, and to arguments that are as logical as mathematics. It is the popular writers who are so apt to disseminate ideas that have no scientific basis.

METEOROLOGY AS A COLLEGE COURSE.

In previous numbers of the MONTHLY WEATHER REVIEW we have stated rather fully the recent work of members of the Weather Bureau in the matter of instruction in meteorology, either collegiate or otherwise. It will be interesting to review the early activity of our colleagues in this matter. Thus we understand that in 1887–88, at Northfield, Vt., Prof. H. J. Cox inaugurated a course of meteorology as a member of the faculty of the Norwich University.

In 1885 the president of the Columbian University invited the Editor to establish a course of instruction in meteorology and climatology in the Corcoran scientific school of that institution. In 1877 the board of directors of the Cincinnati University invited Mr. S. S. Bassler, then in charge of the station in that city, to give instruction in meteorology as a part of the regular course of the university. Preparations for this work were completed when Mr. Bassler was transferred to Chicago, Ill., in November, 1877, and the project fell through.

The Editor would be glad to receive short statements of the early services of other men in this special field of college work. If those residing in university or college towns would look up the history of the respective institutions and send us short notes as to the instruction given in our science, usually as a part of the duties of some professor of astronomy, chemistry, geology, or physics, these would constitute interesting contributions to the history of the part taken by American colleges in the development of this science. It is quite common to forget what was done a hundred years ago, but most of us probably know that Prof. Elias Loomis taught this subject quite thoroughly from the beginning of his career at Yale College, 1833; then in the Western Reserve College, at Hudson, Ohio, 1837–1844; again at New York University, 1844–1859, and finally at Yale University from 1860 to 1889.

In former times this subject was usually taught in connection with some other science; thus Prof. Robert Hare, the chemist, wrote and lectured on meteorology in the University of Pennsylvania, 1818–1847. Prof. Joseph Lovering, the physicist, included this in his lectures at Harvard University. His present successor, Prof. John Trowbridge, has also interested himself in vortex motions, atmospheric electricity, and other meteorological problems, but the special teaching of meteorology is left to Prof. R. deC. Ward. Professor Olmstead, at Yale, and now Professor Brewer, at the same institution, also Professor Renwick, at Columbia, have taught meteorology as a part of the courses in physics and chemistry. Professors Chamberlin, at Chicago, and Tarr, at Cornell, include it in geology and physical geography. Nearly all the professors of natural philosophy have given it some attention ever since the days of Newton and Cotes at Cambridge, England, but natural philosophy is now generally broken up into special courses of physics (which is sometimes subdivided into mechanics, optics, acoustics, and electricity), chemistry, geology, meteorology, etc. At the University of Michigan, Prof. M. W. Harrington gave special courses of lectures on climatology for several years before he was appointed Chief of the Weather Bureau. We do not seem as yet to have anything in America quite equivalent to the eminent professorships of meteorology held by Kämtz, at Dorpat, Schmid, at Jena, von Bezold, at Berlin, and Hann, at Vienna.

MARS AND THE EARTH.

On December 16 Professor Pickering, of the Harvard College Astronomical Observatory, received from his assistant at the Lowell Observatory at Flagstaff, in Arizona, a telegram saying that a shaft of light had been seen to project from the planet Mars, lasting seventy minutes. Whenever anything remarkable is observed in the heavens the facts are at once telegraphed to all interested astronomers in order that they may concentrate attention upon the subject, and add as much as possible to our knowledge before the fleeting phenomenon has vanished. This was done in the present case, telegrams being sent to astronomers in both Europe and America. The Lowell observatory gives especial attention to the planet Mars, and has already published a magnificent volume showing the apparent changes that occasionally occur.

This simple announcement of an observed fact has come back to America as a news item scarcely recognizable, viz, that Professor Pickering has been in communication with the planet Mars. This story has brought out from Tesla the statement that he also has observed on his telegraph wires electrical oscillations that may have come from Mars or some other planet, though he does not give us any data by which to judge of the rationality of this conclusion. Following him, Mr. William A. Eddy, of New York, announces that ever since 1890, or whenever he flew his kites by means of metal wire, he was liable to receive electric currents that must have come from some planetary region, or possibly, the sun, or the upper atmosphere.

Following upon these newspaper paragraphs an occasional correspondent inquires, first, as to their authenticity, and next as to their relation with meteorology.

We think we have said enough to show that the original observation published by Professor Pickering is reliable. We believe the other observations by Tesla and Eddy are probably explicable as the result of the ordinary irregularities in terrestrial magnetism, and do not necessarily place us in connection with planetary bodies. Finally, we agree with our colleague, Mr. Talman (and others who have written on the subject for a century past), as to the extreme improbability of there being any one alive on any of the planets with whom we could have intelligent exchange of ideas, even if optical or electrical signals could be sent and received.

Recent studies by means of liquid air have shown that the earth's atmosphere is undoubtedly constantly giving to and taking from interplanetary space a little of the more vol-

atile gases, hydrogen, helium, neon, argon, xenon, and krypton—we might thus occasionally interchange a molecule or two with Mars or Jupiter—but these interesting possibilities should not be heralded as the meteorology of the future. Meteorologists are not studying these finer but the ordinary grosser phenomena of the earth's atmosphere.

At the present time there is absolutely no evidence that the moon or planets have any appreciable influence on the earth, except the well-known ocean tides and the astronomical perturbations due to their gravitational attraction. Of course, they give us a little light in the night-time, but that would scarcely be spoken of as a powerful influence.

OSCILLATIONS OF THE LAKES AND THE CLIMATE IN ARID REGIONS.

The recent reports from Salt Lake City show that the great Salt Lake is now at a lower level than has previously been recorded, by nearly one foot. During the past three years the water available for keeping the lake up to its average height has been materially diminished, that is to say, there has been less rain and snow than the normal, and more sunshine and wind. Similar experiences are reported from India and the Pacific. Thus we learn from a contemporary newspaper that Lieut. O. Olufsen, of the Danish army, well known by his explorations in central Asia and on the Pamir Plateau, says that within the past few years the quantity of water in the streams and wells of Turkestan and Bokhara has notably diminished. This is particularly true of the Syr Daria and the Amu Daria. The Lake Yechil Kul has shrunk from a circumference of 120 miles to one of 40. A somewhat similar story comes from South Africa, where Lake Ngami has dried up greatly within the past ten years, and the natives have been obliged to retire from it.

All these observations do not indicate a permanent change in the condition of the atmosphere. These lakes have all gone through many similar dry periods before this, some of them have dried up very much since they were first formed, but these changes require immense geological epochs. The climatological pendulum swings to and fro very slowly. The annual variations of mean temperature, wind and rain, sunshine and evaporation are rapid and large but they oscillate about the same mean values that obtained a thousand years ago.

EROSION DUE TO HEAVY RAINS AND STEEP GRADES.

The study of physiography teaches us that most of the mountain ranges and hills are simply the outlasting harder portions of the soil and rocks that have not yet been worn down by the steady action of the rains, the frosts, and the rivers. The greatest amount of denudation has taken place in regions of heavy winter freezes and abundant spring and summer rains, but the deepest and most precipitous canyons occur in regions that have but little frost and only occasional but heavy local rains. In these regions a comparatively small watershed of very steep gradient carries a mass of water downward with such force as to do far more erosion and other damage than if the same rain were spread over a longer period of time. Perhaps this principle is well illustrated in the following extract from the Examiner of San Francisco, Cal., November 27. The account there given may be exaggerated, but in general terms it well presents the nature of a phenomenon which is frequently occurring in our arid regions.

On Tuesday, November 20, at Santa Cruz Island, there was a terrific rain. For several hours the water supply poured from the sky, the fall amounting to a cloudburst on the tops of the island mountains. From the harbor a long canyon or valley runs 6 miles up into the mountains, draining an immense watershed and having a fall of about 2,000 feet. A day or two of drizzling rain started the little creek, but it soon became a powerful torrent. Immense volumes of water rushed pell mell down the bed, washing brush, driftwood, and even trees out to sea. The noise was something frightful. It was a low, deep roar from the crashing together of great rocks.

The sloop lay a quarter of a mile off shore in water that was practically fresh. The debris from the island was all around her and the creek waters could be traced far past her. Captain Julius rowed ashore a day later. The beach had receded 100 feet from its former position. The canyon was cleared to bedrock of all movable things.

MIRAGE OVER LAKE MICHIGAN.

A beautiful mirage was witnessed at or near Chicago, Ill., on December 20, 1900, when the observers, looking eastward, saw perhaps 30 or 40 miles of distant lake shore elevated so as to become visible.

The view was elevated above the horizon and was enveloped in a pale blue light. It formed the lower lining of a maze of darkness that hung over the lake shortly after noon and was visible for more than an hour. It faded from view by slowly vanishing from both ends until nothing but the blackened smoke that had floated out from the city's smokestacks remained to be seen.

It appeared in view as slowly and as majestically as it vanished. There was a dark streak between it and the horizon. Prof. H. J. Cox says:

The atmospheric conditions were perfect for such a mirage; there was scarcely a breeze astir; the lake was smooth and the warm rays of the sun slanted down under the bank of smoke.

METEOROLOGY AT THE PARIS CONGRESS OF 1900.

In the Meteorologische Zeitschrift for November, 1900, the editor published a full account of the proceedings of the general Meteorological Congress called by the authorities of the International Exposition, and also of the permanent meteorological committee appointed by the International Congress of Meteorology and its subcommittees. Meteorologists from all parts of the world were in attendance on the congress, and its proceedings were quite interesting. Among the papers worthy of mention were those by Paulsen, on the spectrum of the aurora; Hildebrandsson, on the work of the cloud committee; Sprung, on automatic apparatus for measuring the height and velocity of the clouds; Edelstam, on actinometric measurements made by Angström and himself on Teneriffe with the new Angström pyrheliometer; Algue, on microseismic observations during storms.

In general, however, the attention of the congress was mainly given to the meteorology of the upper regions of the atmosphere. And this was right. The interest that every meteorologist must have in the knowledge of the processes going on in the upper strata of the air was stimulated most thoroughly, and the results described by the untiring and successful students in this field of research called forth, not only expressions of satisfaction and admiration, but gave occasion, even in wider circles, to the mature resolution to actively cooperate with those who have done the pioneer work in the exploration of the upper regions. All the meteorologists best known for their work with balloons and kites (Rotch, Teisserenc de Bort, Assmann, and Hergesell) communicated some account of their arrangements and results. A copy of the magnificent work, in three great volumes, Scientific Balloon Ascensions, by Assmann and Berson, was presented by Assmann. The newest extensions of meteorological services were presented in papers by Rona, on the work of Konkoly and the new Meteorological Observatory in O'Gyalla, Austria; by Nakamura, on the meteorological service of Japan; by Ballif, on the meteorological service in Bosnia and Herzegovina; Chaves, on the meteorological service of the Azores. Weather shooting or hail shooting was reported on for Italy, Hungary, and Austria, and it was agreed that this widespread craze must be utilized as a means of obtaining data for the study of hailstorms. No special subcommittees were appointed by the congress, but the subcommittees of the permanent committee seem to have acted as such, thereby giving rise to some confusion as to the spheres of these two distinct bodies.

In the session of the international subcommittee on aeronautics, the best methods of carrying on the exploration of the atmosphere with sounding balloons and kites were thoroughly discussed. Its conclusions were adopted by the international committee, which met on the afternoon of September 15, after the close of the congress and held its session in the room at the top of the Eifel Tower. Teisserenc de Bort obtained the best results with lacquered paper balloons of from 50 to 100 cubic meters in volume, and these were recommended by the subcommittee, which also recommended that all the self-registering apparatus carried by balloons and kites should be made according to the model of that made by Richard for use at Trappes.

The subcommittee on clouds listened to an interesting address by Poey on the classification of clouds; the cloud measurements in Russia were treated of by Rykatcheff, and those at Blue Hill by Rotch; an automatic telemeter for the measurement of cloud heights was described by Sprung.

The committee on solar radiation listened to Edelstam explain the construction and use of the new electric compensation pyrheliometer devised by Knut Angström, and the apparatus for the measurement of the general light of the sky devised by Dr. Onimus.

The subcommittee, on the improvement of the telegraph service, contended earnestly for the removal of the three or four hours' difference in European observations, but the difficulties in the way of accomplishing this were so great that it was decided to refer the subject to a committee consisting of official delegates representing the interested states.

Professor Mascart presided over the congress and subsequently over the permanent committee; Hildebrandsson was chosen as secretary of the committee.

The permanent committee adopted the two following resolutions:

1. The directors of meteorological institutions are invited to make observations on the movements of the clouds and, if possible, photogrammetric observations of their altitude and velocity on the days of international simultaneous balloon ascensions, which will be properly announced beforehand, in order that these observations may have the widest extension possible. It is also desirable that such observations shall be made on the day before and the day after the balloon ascensions.

2. The international meteorological committee requests its president, through his government officially, to bring about that the military aeronautic establishments of France and other countries, as well as the central meteorological institutes, be required by their governments to take part in the monthly international scientific balloon voyages. The next session of the international meteorological committee will be held in 1902 in London.

METEOROLOGY AND GEODESY.

The United States Coast and Geodetic Survey has recently published a volume containing Dr. Schott's report on the general results of the Transcontinental Triangulation and the American Arc of the Parallel. In its present shape this work was officially begun by Prof. Benjamin Peirce, the third superintendent of the Survey, while the completion of the work and of the volume marked the last year of the incumbency of Prof. H. S. Pritchett. It is only proper to add that for many years the senior assistant of the Survey, the Nestor and educator of American geodesists, Mr. C. A. Schott, has been guiding the work of the Survey in this direction. There are many matters in which geodesy and meteorology have a common interest, and the Weather Bureau is perhaps equally interested in the proper prosecution of the work of the Coast and Geodetic Survey, the Hydrographic Office of the United States Navy, the topographic and hydrographic work of the United States Geological Survey, and the instrumental work of the proposed Government bureau of standards. In examining this last great volume on triangulation a number of items have attracted our attention which it will be profitable for all to consider who are interested in meteorology.

The general object of geodesy is to determine first the general size and shape of the earth and distribution of the apparent force of gravity, and then their irregular deviations. But these are the very figures that lie at the base of all meteorology. It is true that the meteorologist has provisionally assumed a spherical globe and the distribution of gravity that belongs to a homogeneous ellipsoid of revolution, but the accurate work of the Coast Survey will show us to what extent these assumptions deviate from nature, whence we may judge what effects such deviations will have in meteorology. For instance, in the American Meteorological Journal, May, 1894, Vol. XI, page 1, the Editor has endeavored to show that the observed abnormal variations of gravity along a parallel of latitude from Washington to San Francisco are of the same order of importance as the viscosity or internal friction of the air, consequently the variations in gravity must be considered in any investigation that takes into account viscosity as contributing to the resistance which we call friction. Both must be considered or both neglected together. The most important friction terms in meteorology are those that arise from the resistance of the land as compared with the ocean, or of mountains and waves as compared with smooth surfaces, and an equally important source of resistance, which for brevity the Editor has called convectional friction, arises from the fact that ascending and descending currents, as they intermingle, resist each other's horizontal motion, because one of them, usually the ascending current, has a decidedly slower motion than the other, or perhaps even a movement in the opposite direction. The general rise of the barometer up to its maximum at 10 a. m. seems to be explained by the fact that a part of the greater kinetic energy of the swifter currents that descend to take the place of rising air is transformed into pressure or potential energy, both because its horizontal component must push the lower air along faster than it was previously going, and because its vertical descending component is resisted by the earth. Whenever a rapidly moving fluid gives up a part of its momentum to a more slowly moving fluid or solid an increased elastic pressure is produced within both fluid masses, similar to the resisting pressure at the head of a rapidly moving projectile. For velocities less than that of sound, and for changes of pressure and velocity that are produced almost adiabatically, the new pressure and volume P_1 and V_1 are connected with the initial P_0 and V_0 by the equation

$$P_1/P_0 = (V_0/V_1)^{1.407}.$$

The second part of Dr. Schott's report is devoted to the determination of the heights of the stations above mean sea level. The foundation of this work is a continuous line of spirit levels of the highest degree of accuracy, extending from Sandy Hook, N. J., on the Atlantic coast and tidewater on the Gulf coast to the eastern flank of the Rocky Mountains at Colorado Springs, Colo., thence by triangulation westward to the Sierra Nevada, and thence by levels to the Pacific Ocean. The middle portion of this line will eventually be replaced by continuous leveling, a rather tedious operation, over the Rocky Mountain Plateau, but essential in consideration of its practical applications. The results published in Part II deal more directly with the primary triangulation stations whose approximate elevations are needed for the computation of the length of the arc of the parallel. A short table is given showing that the new determinations differ by quantities as large as −355 and +242 feet from the older determinations of altitude. The elevation of the Weather Bureau station on the summit of Pikes Peak is reduced from

14,134 to 14,108 feet, which correction is in fact very moderate and is due largely to errors in the railroad leveling, cumulative from St. Louis, Mo., to Colorado Springs, Colo. The levels and other measurements carried westward from the Atlantic to Mount Corness in California gave its altitude 12,585, while the levels carried eastward from San Francisco Bay at Oakland, Cal., gave 12,556. The discrepancy is small, but its larger part will undoubtedly be removed when the accurate leveling across the Rocky Mountain region is completed. The reduction of Weather Bureau stations to sea level depends almost wholly on altitudes deduced from the innumerable railroad and canal surveys that are spread over the country and every increase in the accuracy of these levelings, or the substitution of the high class work of the Coast Survey is to be welcomed by the meteorologist.

Whenever the Survey substitutes the measurement of vertical angles in place of leveling, as it has done in the case of the long lines of sight from mountain top to mountain top, it has to contend with the problem of the refraction of rays of light passing through the earth's atmosphere. This refraction depends upon the density of the air as a function of moisture, temperature, and pressure. The results of the observations and calculations contained in Part II have, therefore, a profound interest for the meteorologist. He obtains some insight into what is going on at a height of 10,000 or 20,000 feet above sea level, in a region otherwise accessible to him only by kites or balloons. The general changes in the distribution of temperature are suggested by the observed hourly values of the coefficient of refraction, as determined from the elaborate work of the Coast Survey. Observations on the coast of Maine and the coast of California, as well as in the interior of the Rocky Mountain region, lead to several interesting results: the refraction is greater and more irregular during the night hours than during the day; the maximum value is within two or three hours of midnight, and the minimum within two hours of noon; the average of the twenty-four hours is greater the nearer the line of sight is to sea level, or it steadily increases as the height above sea level decreases, except where the temperature is abnormally high or low; the computed refractions are most reliable between the hours 10 a. m. to 5 p. m., but during most of this time the images are faint and unsteady, and observations are difficult. The diurnal range of the refraction is greatest at the low stations; the coefficient of refraction is smaller in proportion as the lines of sight are shorter, probably because the sight-lines then also pass nearer the heated ground where the warm stratum of air is found; when ground is barren and treeless and the climate very dry, and the line of sight passes close to the earth the coefficient is smallest; refraction is larger on the coast as compared with the interior, the average of nineteen sight lines near the coast gave the coefficient $m=0.0854$, whereas lines in the interior, a little farther eastward, gave 0.0751.

As the coefficient of refraction must depend, among other things, upon the horizontal distribution of pressure and temperature, it is important that the geodesist should, in the future, consult the daily maps of isobars and isotherms in order to introduce greater accuracy into these calculations and explain away some of the anomalies that occur. The Weather Bureau station on Mount Tamalpais must be near the geodetic station, whose altitude is given on page 279 as 2,594.3 feet.

The steadiness of an object in the field of view of a telescope depends upon the oscillations or minute variations in the refraction of light at every point of the long line of sight through the atmosphere. When one looks at a star his line of sight penetrates a great distance of very rarefied air, equivalent if the star is in the zenith to about eight miles of air of the standard density at sea level; but when the star is in the horizon, one may be looking through 50 or 100 miles of such air, and the star is seen to be a much distorted disk having the colors of the spectrum, and dancing about in such a fashion as to constitute the worst possible condition for accurate measurements. Now, the lines of sight between mountain tops in the Sierra Nevada and the Rocky Mountains have been in one case as long as 182 miles. At this distance nothing can be seen except the image of the sun reflected from the heliotrope mirror and shining as a dull red or yellow patch through the atmospheric haze. The hours and days on which this image stands steadiest are those selected for geodetic work, they are also those which show when the atmosphere is clear and quiet, or when ascending and descending currents are producing the least disturbance. The observers record that on long east and west lines, when the sun is below the horizon of the observer, it may still be above the horizon of the distant heliotrope mirror, and be thereby observable in his telescope for several minutes after it has entirely set to his own direct observation. The "seeing," that is to say, the steadiness of image is greatest from sunrise to 8 a. m., and from 4:30 p. m. to sunset; the seeing is usually better in the morning than in the evening; on the long lines the minimum refraction of the day occurs late in the afternoon, even after the maximum heat of the day at the earth's surface has passed by.

On these mountain stations meteorological observations are made such as dwellers in the low lands never experience. It would seem almost impossible for the students of meteorology ever to accumulate enough data from these regions to give us a complete survey of the wonders of our atmosphere. We quote the following from page 554, in which assistant W. Eimbeck describes his experience on Rocky Mountain summits in 1885 and 1895:

> It may be remarked that the conditions of the weather on these high mountains could not be called unfavorable during the ordinary field season, which lasts from about the 1st of June to the 1st of November, excepting, however, the period of thunderstorms in midsummer. These thunderstorms, on account of their persistency among the high mountains, have frequently given rise to much suffering, danger, and delay in the progress of the work. They would envelope or hover around the mountains for days in succession, accompanied by the most violent electrical discharges and thunderbolts imaginable. During such times the whole mountain top fairly hummed or hissed by virtue of escaping electricity, and sparks a couple of inches in length could easily be drawn from any exposed insulated object. These storms would usually set in about 11 o'clock in the morning and last till long after sunset. Though no fatality is, fortunately, to be recorded, they proved, nevertheless, the main cause of discomfort and danger to the party exposed to their fury. The highly attenuated state of the atmosphere, the icy blasts during stormy periods, often accompanied by hail and snow, contributed their share to the depressing and dismal feeling during such exposures. The experience of the heliotropers would seem to have been perilous, for three of them were knocked down and rendered partly unconscious, while a tent, several signals, and a theodolite were demolished by lightning. The (so-called) equinoctial snowstorms which annually break over these mountains with surprising regularity were usually borne without concern. They arrive about the beginning of October and, though sometimes severe and followed by intense cold, they seldom caused other than mere temporary interruption in the communication with the camp below.

For further details of similar experiences on the summit of Pikes Peak see the journals of the Weather Bureau observers, as published in full in the volume of observations printed by the astronomical observatory, Harvard College, Cambridge, Mass. As the relative positions and elevations of stations on the summit of Pikes Peak will always be of interest in meteorology, we take the following items from Mr. Tittmann's report on page 570. The old Signal Service station (1), occupied from October, 1873, to September 30, 1888; the new Weather Bureau station (2), occupied from September 8, 1892, to September 30, 1894; the Coast and Geodetic Survey latitude pier (3), and the edge of the bluff

(4) have the following positions relative to the geodetic triangulation station (T) marked by a drill hole in the concrete foundation of the pier on which the theodolite was mounted: The pier is 12.8 feet high; No. (1), or the northwest corner of the old Signal Service building, now used as a stable, is 177.4 feet southeast of the triangulation pier (T); No. (2), or the south chimney of the new Weather Bureau building, is 525.26 feet south, 75° 41′ east of (T); No. (3), the latitude pier, is 18.11 feet north, 88° 41′ west of (T); the nearest point of the bluff is distant about 72 feet north-northwest of (T). Differences in level are not given, but it is stated that the top of the peak is flat and nearly level, is a Government reservation covering many acres, and has easy access by means of the Manitou and Pikes Peak Cog Railway.

The so-called Great Hexagon has for its central point Wheeler Point, Nev., formerly known as Jeff. Davis Peak, in the Snake Range, White Pine County, Nev., latitude 38° 39′ N.; longitude 114° 19′ W. This station was established in 1878. A hexagon of slightly inferior dimensions adjoining it on the west, having Toiyabe Dome as its center. The meteorologist, knowing well the great snowfall and terrible storms of this region, can appreciate the remarks on page 572:

> While engaged upon the work on Wheeler Peak (November 5–23) the party was practically buried in a snow drift 10 and 12 feet deep, the temperature of the air sank to 20° below zero Fahrenheit, and in order that the observations upon distant stations might be continued, deep and broad trenches had to be cut through the snowdrifts in the line of sight. The party suffered much from the intensity of this cold wave. The high snowdrifts which covered the living tents to within a foot or two of the apex saved the party from freezing to death.
>
> At this station the brilliancy of the reflected moonlight suggested to the observer the selenotrope for occasional use at night, and it was experimented with at other stations.

The cold wave here referred to was apparently that which occurred in connection with the area of high pressure No. II, as described in the MONTHLY WEATHER REVIEW for November, 1882. The snowfall for that month was above the normal in the northwestern portion of California. The auroral displays were unusually frequent and brilliant and the accompanying electrical or ground currents on telegraph lines were unprecedented in Europe, as were also the magnetic storms of November 16–23. Auroras were recorded at Salt Lake City, Utah; Los Angeles, Cal.; Yuma, Ariz.; San Diego, Cal.; Galveston, Tex.; Punta Rassa, Fla., and thence northward into Canada, being the most remarkable exhibition on record since 1859.

On pages 733–777 Dr. Schott discusses the effect upon geodetic work of the periodical change in latitude discovered by the astronomer, Dr. S. C. Chandler, At the present time these variations are less than one second of arc and are so nearly periodic that we are not yet able to speak of an appreciable secular change in latitude. But there can be no assurance that the rise and fall of continents and ocean beds and the consequent shifting of ocean water may not in the past have caused appreciable secular changes in the position of the pole relative to the earth. Of course, such changes would necessarily bring such a strain upon the earth's crust that it would yield or bend and crack, or rather, the trends and faults would cause the axis and latitudes to change. The earth taken as a whole, when we consider the geological faults that exist everywhere, must be treated as a viscous body continually yielding to strains due to luni-solar tides, the gravitation of its mass, the weight of the ocean, the atmosphere, the great lakes, and the great glaciers. It is rigid as steel to the strains of short periods, but plastic under long-continued strains. The yielding process is so slow, the faults proceed step by step so gradually, that great changes in surface features require geological ages for their evolution, while during this whole long time the general figure of the earth may remain the same as at the present day, i. e., the Clarke spheroid. It is certainly very interesting to learn, from page 871, that a combination of all the American measures shows that Clarke's spheroid of 1866, whose polar radius is 6,356,584 meters and equatorial radius is 6,378,206 meters represents the shape of the western continent quite accurately, and will continue to be adopted by the Survey until the measure of a meridional arc enables us to adopt definitely something appreciably better.

PERIODICITY IN METEOROLOGY.

The Weather Bureau has lately received many communications relative to supposed periodic or other systematic changes in the weather, depending upon variations in the Gulf Stream, variations in the sun spots, earthquakes, changes in terrestrial magnetism, and other more or less elusive subjects.

These communications must be taken as simply an evidence of the great importance of the weather to the human race. All wish to know about the laws that govern the changes in climate in order the better to arrange their business affairs. One correspondent asks whether the Gulf Stream has not undergone such changes as to prevent the recurrence of the damaging frosts and freezes that have done so much injury in Florida during the past six or eight years. If we were able to assure our correspondents that we understand all the laws that govern frosts and storms, they might indeed lay aside the ordinary precautions against disaster and proceed calmly in the assurance that such troubles are not now imminent; but it will not do for any one to discard protection against injurious conditions. If any periodicities have been discovered they are such as to be of very little importance in comparison with the ordinary irregularities of the weather. Thus, Brückner finds a period of about thirty-five years in the annual average temperatures, but the extent of this regular period is about half a degree Fahrenheit, while the irregularities in the annual mean temperatures amount to five or ten degrees. Köppen, by examining the mean annual temperatures for the world, found that in equatorial regions there was an amplitude of about one degree Fahrenheit, corresponding with the variations of the sun spots; but in polar latitudes this disappears, and the irregular nonperiodic changes become much larger. Quite lately, Lockyer, in a joint paper with his son, showed that possibly there may be a connection between the condition of the solar atmosphere, as shown by the widening of the lines of the solar spectrum, and the rainfall, temperature, or other meteorological phenomenon.

Now, all these and many other investigations go to confirm us in our belief that all the phenomena of nature, whether solar or terrestrial, physical or biological, are so intimately connected that through any one of them we may get some idea of what is going on in the other department, but they do not in the least justify us in believing that the principal fluctuations in one can be ascertained by studying those of another. To those who have studied the atmosphere it is plain enough that it contains within itself the elements and forces that are able to bring about all the great irregularities that affect mankind. Even the great changes of climate that appear to have occurred during geological ages can probably be explained by the study of the atmosphere and the earth, without having recourse to the stars, sun spots, meteors, magnetism, electricity, or Fourier's hypothesis of warm and cold regions in the space through which the earth is supposed to travel.

MATHEMATICS IN METEOROLOGY.

The magnificent mathematical work on the motions of the atmosphere, by Prof. F. H. Bigelow, published in the second volume of the Report of the Chief of the Weather Bureau for 1898–99, and the similar studies by other eminent mathematical physicists, such as those by Diro Kitao, of the Agricultural College in Tokio, by von Bezold and von Helmholtz in Berlin, Margules in Vienna, Hertz of Kiel, Oberbeck at Tübingen, Guldberg, and Mohn at Christiania, and Ferrel at Washington, must impress every student of meteorology with the desire to master the mathematical methods that have led to these brilliant results. It is impossible to confine meteorology to mere observation, telegraphy, and charting. Even the observational exploration of the upper air by kites and balloons and by the study of the clouds does not wholly respond to the demands of the situation. Back of the facts there must be reasons why, and these laws constitute meteorology. The forecaster stands in the presence of a complex problem in mechanics that must be solved by the methods introduced into the study of mechanics by Sir Isaac Newton and developed by a host of devoted experts, such as Poisson, Laplace, Jacobi, Lagrange, Maxwell, Helmholtz, and such living authorities as H. Poincaré, Kelvin, Klein, Rayleigh, J. J. Thomson, Heaviside, and others too numerous to mention. In the October number of the MONTHLY WEATHER REVIEW we have recently published a paper by Prof. V. Bjerknes that presents one of the simplest problems in a manner that is as elementary as is any way possible, consistent with the exact discussion of the subject; but in the application of his ideas, and especially in an effort to understand their rationale, one has to call to mind mathematical formulæ that are only found in the higher text-books of mechanics and mathematical physics. Although the majority of the readers of the MONTHLY WEATHER REVIEW will look askance at these formulæ and wonder if they are really necessary or merely a pedantic show of learning, yet, those who have any true comprehension of the problems will recognize that they can not be dispensed with, and that those to whom they seem incomprehensible must study the higher mathematics if they intend to keep up with the highest progress in our science. About 1877 the Editor translated a number of short memoirs that will be found in the Report of the Secretary of the Smithsonian Institution intending them as a guide and convenience to American students. In 1891 he prepared another collection of translations, published also by the Smithsonian Institution as The Mechanics of the Earth's Atmosphere. There are many more papers of great value still awaiting publication. All this has been done that American students might be left without excuse if they neglect the fundamental study of the atmosphere. The Editor's hope has been that the seed thus sown would in some few cases fall upon good ground; that some universities would give mathematical meteorology as prominent a place as they do mathematical astronomy; that some professors and students would take up the subject in earnest, and that Americans contributing to these higher studies might achieve equal distinction with that attained in observational work and in practical forecasts. These publications must be looked upon as paving the way for the meteorology of the future, when it will be as much superior to that of the present as the present astronomy is superior to that existing before Newton's day.

A friend has lately expressed the desire that the MONTHLY WEATHER REVIEW should publish a series of articles explaining what mathematical and physical training is required if a man would fit himself to become a working meteorologist. Probably, by working meteorologist is meant an observer and forecaster, and, therefore, the reply must be that he should understand the sources of error of his instruments and the methods of investigating their errors. This implies pretty much everything that is taught in the undergraduate courses of schools of science as to algebra, plane and solid geometry, plane and solid trigonometry, theory of errors, mechanics of solids and fluids. If now this working meteorologist and forecaster is to understand the errors of distortion on the maps and charts of the world that he has to use instead of a sphere, then, he must understand projections. If he is to understand and interpret the phenomena of the rainbow, the halo, etc., he must study optics or the theory of light. If he is to understand the action of moisture in the atmosphere and the formation of rain, snow, and hail, he must conquer thermodynamics. If he is to understand the motions of the atmosphere he must study hydrodynamics and the theory of equations.

Now all these matters are taught in all first-class schools of engineering, so that the difficult science of meteorology requires but little more fundamental learning than is required of electrical or hydraulic or steam engineers, but it certainly requires every bit of that. One may study these subjects year after year while supporting himself by his regular work on station, but of course it is better to have acquired them in college beforehand. It is not to be supposed that many will have the intellectual gifts requisite for this work, but no one can tell beforehand to how high a degree he may attain by persistent work. Professor Ferrel's life was one continuous study and advance. Attack the problem and you will succeed in proportion to the earnestness of your attack. The successful man is the one who perseveres.

A MEMORABLE STORM OF SLEET AND SNOW.

We publish on Plate I, figs. 1 and 2, two half-tones from photographs kindly furnished by R. G. Allen, Section Director, Ithaca, N. Y., illustrating the great damage done on November 22–24 in the highlands of western New York by the heavy fall of snow and sleet. On this point the Herald, of Hammondport, says:

> The falling moisture clung to and froze fast upon everything. Nearly every fruit orchard was more or less damaged, and some were totally ruined. Thousands of trees were either uprooted or thoroughly stripped of branches. Whole tracts of forest were similarly affected, in many instances being crushed to the ground, * * * Fruit trees of almost every description were more or less damaged. Young orchards escaped with slight injury, from the fact that the weight bent the trees to the ground, thus saving them. It is said that one and one-half inches of ice formed on every twig and branch of the trees. This will give a faint idea of the immense weight. One man says that in a tract of second growth hickory and white oak from thirty to fifty feet tall, the trees were bent entirely over, the tops resting on the ground. When the sun loosened the ice many sprung back, but portions of them were splintered and ruined. The drippings from pine boughs formed in many instances complete thatched roofs. Pine timber was, therefore, less injured than others, from the fact that all of the pine boughs were so closely bound together that the weight was more equally distributed.
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> One of the strange sights of the effects of the storm was that upon wire fences. In many cases they were one solid sheet of ice, with scarcely a crevice large enough for a field bird to penetrate. The amount of damage can hardly be estimated but it will be immense at the best. In the memory of the oldest inhabitant nothing like it has ever been known in this region. The result will be a great scarcity of apples and other fruit for years to come in the region thus affected.

HURRICANES AT CHARLESTON, S. C.

In a review of the past century published in the Charleston, S. C., News and Courier, of January 1, 1901, there is given a catalogue of the various hurricanes and other meteorological events of interest, from which we take the following dates:

1752.—The most dreadful hurricane.
1783.—A hurricane of much less violence.
1804, September 7.—A hurricane and high water that did great damage.
December, 1811–February, 1812.—A series of earthquakes producing much alarm, but no great damage.
1813, August 27.—A fearful hurricane, doing great damage; the water rose 18 inches higher than in the corresponding gale of 1804.
1822, September 27.—Destructive hurricane.
1854, September 7.—Violent gale.
1875, September 28.—Severe gale.
1885.—Destructive hurricane.
1886, August 31.—Fearful earthquake.
1893, August 27–8.—One of the most destructive hurricanes.

The paths of West Indian hurricanes, including those that sometimes develop in the Gulf of Mexico, are liable to strike any point of the Gulf or south Atlantic coasts. On the average, there must be three or four hundred such storms in every century, and if these were distributed uniformly along this stretch of coast, 3,000 miles in length, we should have an average of one per century for every 100 miles. But the coasts of Georgia, South Carolina, and North Carolina have probably twice as many of these storms per square mile per century as occur on other portions of these coasts. When we go farther north, into the Middle States, New England, and the Lake region, there are few hurricanes, but the number of severe storms is much larger, owing to the fact that we have here another type of storm, viz, that which passes from the Pacific coast eastward toward Newfoundland.

HIGH TIDES AND APPROACHING STORMS.

Mr. F. Napier Dennison who is now living in Victoria, B. C., in a recent letter says:

I am getting most interesting records from my hydroaerograph records, especially before certain types of storms, as well as the secondary undulations. I often observe abnormally high tides before some of the great Pacific storms strike our coast.

CUMULUS CLOUDS ABOVE FIRES.

Referring to the MONTHLY WEATHER REVIEW, October, 1900, page 433, Mr. R. M. Hoskinson, Voluntary Observer at Waycross, Ware County, Ga., under date of January 16, says:

During a residence of twelve years in Osage County, Kans., I have often seen the dense smoke rising from the burnt grass ascend in cloud-like forms. The tops of some of these show white, like cumulus clouds. In order to be seen thus, the observer must be quite a distance away—a half mile or more—standing with his back to the sun.

Mr. H. H. Ten Broeck of Braidentown, Fla., under date of January 7, 1901, says:

I have often seen columns of smoke capped by cumulus clouds; this has always been when there was little or no wind, the smoke ascending nearly vertically. I have seen them on the prairies of Minnesota and other regions. A few days ago I saw the greatest development. A large brush fire was burning some three miles off, sending up a dense column of smoke, almost vertical. On the top of the column was a mass of cumulus cloud with its peculiar dense convolutions, and blending below with the smoke. Smoke clouds never show the pure brilliant white that cumulus clouds do and they are of a different texture, too, so that it is impossible to mistake one for the other. I have not the least doubt, therefore, but that Mr. Mitchell is right in reporting a cumulus cloud on the smoke of the fire at Bayonne, N. J.

LIGHTNING WITHOUT THUNDER.

Under date of January 17, 1901, Mr. Ten Broeck, of Braidentown, Fla., says:

On page 429 of the REVIEW for October, you publish some observations on lightning without clouds. I have known of lightning without thunder. A house next door was struck; I saw a blinding flash simultaneous with a splitting sound and waited for the crash of thunder, which did not come. The house, which was about 20 feet from the one I was in, was struck on the peak of the roof. The discharge followed the shingles about halfway to the eaves, splitting them up; it then turned and went over the gable and into the house, and so on down to the cellar, stunning the occupants, but not doing much damage.

A friend told me he had a similar experience. He was going along the street during a thunderstorm; there was a bright flash, accompanied by a rumbling noise, as he was passing a house, but no thunder. On looking to find the cause of the peculiar sound, he saw that the chimney had been struck and knocked to pieces, the bricks falling on the roof made the rumbling noise that had attracted his attention; but he was astonished that there was no thunder.

AZTEC NAMES AND THEIR PRONUNCIATION.

Messrs. F. P. Hoeck & Company, of the City of Mexico, writing to the Chief of Bureau in reference to the spelling and pronunciation of the names of the two famous volcanoes Popoca-teptetl and Iztac-cihuatal say:

Each word is two words in itself, and in pronouncing them it should be born in mind that the first word, *Popoca*, is accented on the second syllable (*po*); the second word, *tepetl*, is accented on the first syllable (*te* or *tay*). *Iztac* is accented on the second syllable (*tac* or *tak*); *cihuatl* is accented on the first syllable (*ci* or *see*); *hu* has the sound of w, or rather is the equivalent of w in English.

The above spellings are as promulgated by the Board on Geographic Names, in their last report. But this is the first time that we have seen any authoritative statement as to the proper pronunciation.

REDUCTION OF THE BAROMETER TO STANDARD GRAVITY.

At the International Meteorological Conference at Munich in 1891 the following resolution was unanimously passed:

It is recommended to all meteorologists to publish barometric readings reduced to normal gravity as soon as possible, starting from the 1st of January, 1901; moreover, in all tables and charts it should be specifically stated that this correction has been applied. At the head of the tables the adopted value of the reduction to normal gravity should be given in such a manner that one can recognize it immediately with an error not greater than one-tenth millimeter

The Weather Bureau, after many years of argumentation pro and con, adopted the reduction to standard gravity in 1885, but gave it up in 1886, through the mistake and opposition of one person. On January 1, 1899, as has been already announced in the MONTHLY WEATHER REVIEW (see December, 1898, page 550), the use of this important reduction again began and will, doubtless, continue hereafter in accordance with the urgent resolutions of the various meteorological congresses. The readers of the MONTHLY WEATHER REVIEW scarcely need to be reminded that the aneroid barometer is not affected by the variations of gravity, while the standard mercurial barometer is so affected.

The meteorological committee of the International Congress, in its recent meeting at Paris, adopted the following resolutions for the guidance of the international cooperating meteorological services:

1. Beginning with January 1, 1901, and for all stations whose observations are transmitted by telegraph to the central services, the barometric readings should always be reduced to standard gravity.
2. In published tables of observations it will be indicated whether

the barometric readings have been reduced to normal gravity, and also the value of the adopted corrected term, if the readings have been reduced, or the corrections that should be applied to the tabulated numbers in case they have not been so reduced.

HURRICANES IN JAMAICA, W. I.

In a supplement to his second volume of Jamaica Meteorological Observations, Mr. Maxwell Hall published a list of hurricanes and other phenomena occurring in Jamaica from the earliest dates up to the beginning of his regular work in 1880. Owing to the difficulty of making this complete and correct, he has requested that any additions and corrections may be communicated to him. The following is a list of the dates of hurricanes or severe storms only, omitting the descriptive text which Mr. Hall quotes in full. As his list already corrects errors that had crept into Keith Johnson's Physical Atlas, the reader will miss several hurricanes that are popularly credited to Jamaica:

1689, this hurricane was not very severe; 1712, August 28; 1714, August 29; 1722, August 28; 1726, October 22; 1743, October 20; 1751, September 2; 1772, August 31; 1780, October 3; 1781, August 1; 1784, July 30; 1785, August 27; 1786, October 20; 1812, October 12; 1813, August 28; 1815, October 18–19; 1818, November 18–20; 1832, August 7; 1837, September 26–27; 1874, October 31–November 2; 1880, August 18.

COMMERCIAL IMPORTANCE OF STORM AND WEATHER FORECASTS.

A recent decision of the United States circuit court of appeals (fourth circuit, No. 327), rendered on November 8, 1900, has been quite widely commented on by the daily press and is, indeed, worthy of general notice by the mercantile community. It appears that the first decision of the district court of the United States for the district of South Carolina held a vessel and its owners liable for damages to its cargo owing to their failure to observe the weather forecasts and provide protection against rain. The circuit court of appeals reversed this decision and decided that the failure to observe the *rain forecasts* did not constitute negligence in any of the business relations of life, while at the same time recognizing the fact that the masters of vessels are in duty bound to observe the *storm warnings*. As the whole course of the argument is eminently temperate and fair, we reproduce it in full. The result must serve to stimulate the students of meteorology to hasten the perfection of that science whose study has so recently been taken up in the proper way and whose results must be so important to mankind:

The record shows that the German steamship *St. Georg* arrived in Charleston Harbor on the evening of Thursday, the 21st of July, 1898, having on board as part of her cargo 3,039 bags of rice consigned to the libellant, Wilmot D. Porcher, of the City of Charleston, one-half of which was to go to the customhouse; the other half the consignee intended to deposit at his own store. On Friday, the 22d of July, due notice was given the consignee, Porcher, that the vessel would begin to discharge her cargo at 7 o'clock on the morning of July 23. The bill of lading provided that the goods were "to be delivered subject to the terms and conditions stated in this bill of lading, which constitute the contract between the shippers and the company, in like apparent good order and condition from the ship's deck (where the ship's responsibility shall cease) at the port of Charleston, S. C." "Also to discharge the goods from the steamer as soon as she is ready to unload into hulk, or temporary depot or lighter, or a wharf, at the shipper's or consignee's risk and expense after they leave the ship's deck. The goods to be received by the consignee as fast as the steamer can deliver them, and any extra charges incurred after being discharged, necessary for the steamer's quick dispatch, to be paid by the owner or consignee of the goods." The steamer began to discharge about 7:30 a. m., of July 23. The agent of the consignee was sent to receive and remove the goods and reached the wharf about 8 a. m. Porcher, the consignee, went to the wharf about 10 a. m. Klinck, the agent, had ordered a number of drays to remove the rice, but only two had reported at the time he arrived, the others not coming until about 11 o'clock. There were present at the unloading, besides the agent and libellant, the agents of several other consignees. The ship was being discharged at an uncovered wharf, which had previously been used for unloading and discharging perishable goods. The rice was at first piled indiscriminately on the wharf, but on complaint being made, after 50 or 60 bags had been landed, the rice belonging to the separate consignees was put into separate piles. The wharf was, to some extent, obstructed by some railroad cars and by some piles of pig iron and resin for outward cargo; the entrance to the wharf was by a narrow gateway; these obstructions impeded the handling of a large number of drays at the same time. There was at the shore end of the wharf a granary, which the agent of the railroad company, the owner of the wharf, told Porcher he could use to protect his rice in the event of rain. A forecast of the weather for Saturday, July 23, was inserted in the News and Courier, a newspaper published in Charleston. It was the custom of the Weather Bureau to distribute these forecasts generally throughout the city and to post them in about fifty places in Charleston. The forecast from the Bureau at Washington for South Carolina was: "On Saturday, showers and thunderstorms; warmer," etc. The local forecast for Charleston and vicinity was: "Light showers, with a probable moderate thunderstorm, followed by fair late in the day," etc. The morning of July 23 was clear until about 11 o'clock, when there came up suddenly a thunderstorm and a heavy fall of rain, lasting over an hour. The precipitation was 1.60 inches. There had been rain on the evenings of the 20th, 21st, and 22d of July, varying in time from 4 p. m. to 10 p. m. The precipitation on the 20th was .15 of an inch. On the 21st less than one-hundredth of an inch, and on 22d .20 of an inch. There were light rainfalls 25th and 26th of July. When the rain began on the 23d, the rice on the wharf was covered with tarpaulins, but owing to the heavy downpour they did not afford protection. Some of the rice was damaged before it could be gotten under cover, and some by the water running under the bags on the wharf. Neither the consignee nor his agent, nor the agents of the other consignees, previous to the discharge of cargo nor at the time of the discharge, made any objection to the wharf or to the time or the manner of unloading the rice and placing the same on the wharf.

The district court entered a decree for damages in favor of the libellant. The judge of the court below bases the decree on the negligence of the master in unloading the goods on an uncovered wharf in the face of a threatened storm without making effective preparations for protecting the goods for such time as would afford the consignee fair opportunity for removing the same. This he holds to be culpable carelessness, not justified by any necessity, as covered piers were available. And, further, that it was not proved to his satisfaction that the consignee had fair opportunity to examine the rice, to separate it, and remove it before the rain commenced. The correctness of this decision must be determined by those provisions of the bill of lading which provided for the delivery of the goods. These constitute the contract of delivery, and by this agreement construed in the light of principles pertaining to special contracts of affreightment the parties are bound. It is clear and specific in its terms. It states that the goods are to be delivered in good order and condition from the ship's deck, where the ship's responsibility shall cease, at the port of Charleston.

Also, that the steamer is "to discharge the goods as soon as she is ready to unload into hulk * * * or on a wharf at shipper's or consignee's risk and expense after they leave the ship's deck."

Under this contract, the liability of the ship for the safety and security of the goods ceased when the goods were landed on the wharf, the consignee being present and accepting the goods as delivered from the ship's tackle. In the absence of the consignee without notice, where there is a general bill of lading, it is the duty of the master to land the goods at a suitable wharf at a proper time and give the consignee reasonable time after notice to remove the goods. But this doctrine is not applicable to the case at bar, though this is the view urged by the counsel for libellant, and is the view taken by the court below. We must determine this case on the principles applying where the consignee has had due notice, is present in person or by his agent during the delivery, and is engaged in receiving the goods. There is no usage shown as to the delivery of goods at the port of Charleston to change the general rule as to the responsibility of the carrier.

The reason of the difference in the degree of liability of the carrier for the safety of the goods, after their landing from the ship, where the consignee is present, receiving them, and where he is absent at the time of discharge, is that in the former case he has an opportunity, if the goods are not being delivered at a proper place and time and in a proper manner, to object to the delivery. In the latter case he has not that opportunity, and the general maritime usage extends the responsibility of the carrier, as to the protection of the property, after it passes from the ship's deck to the wharf. Contracts of affreightment, in effect the same as that made in this case, have been construed in a number of decisions. The *Santee*, 7 Blatchford, 186, Fed. Cases No. 12330, is a case frequently cited in admiralty decisions, and quoted by text writers on the law of carriers. The law as expressed in that decision is thus stated in Hutchinson on Carriers, 2d Edition, 430, note; The *Santee*, Fed. Cases, No. 12330. 5 Myer's Federal Decisions, 407:

"Where the stipulations of the bill of lading require the consignee to be present and receive the goods as soon as the vessel is ready to unload, and that they shall be at the consignee's risk as soon as landed on the dock, and the consignee is duly notified, and attends in order to accept the goods as landed, and takes more or less charge of them, the stipulation is held to exempt the ship from subsequent loss or damage." In such cases as the consignee has due notice of discharge and accepts the goods, the duty of protecting the property is cast upon him and the ship is released. The *Surry*, 26 Fed., 791.

In *Willis and others* v. *the steamship City of Austin*, 2 Fed., 412, it was provided in the bill of lading: "It is expressly understood that the articles named in this bill of lading shall be at the risk of the owner, shipper, or consignee thereof, as soon as delivered from the tackles of the steamer at her port of destination," and that if the goods were not taken away the same day by the consignee, they might, at the option of the steamer's agents, be sent to store, etc., at the expense and risk of the owner, shipper, or consignee. A case of merchandise had been delivered on the wharf, and was taken away by the draymen of a party to whom it was directed, though not the one for whom it was intended.

The steamer was held not liable for the loss, Choate, J., constructing the bill of lading, saying: "I think, therefore, the case is governed by the case of the *Santee*, and that the sh p is not responsible, because the goods in question were delivered within the meaning of the bill of lading, and the consignees had full notice to attend, and did in fact attend, upon the discharge of the vessel to receive their goods. Libel dismissed, with costs."

In the case of the *Tybee*, 1 Woods, 358, Fed. Cases No. 14304, 5 Myer's Federal Decisions, 362, the bill of lading contained this agreement: "It is expressly understood that the articles named in this bill of lading shall be at the risk of the owner, shipper, or consignee thereof, as soon as delivered from the tackles of the steamer at her port of destination, and they shall be received by the consignee thereof, package by package, as so delivered."

Justice Bradley, construing this contract, says: "The carrier's liability ceases, of course, when he has delivered the goods according to the bill of lading. The general rule with regard to delivery, as laid down in the books, is that, in the absence of a special contract, the goods are to be regarded as delivered, so far as the carrier's responsibility is concerned, when they are deposited on the proper wharf at their place of destination, at a proper time, and notice has been given to the consignee."

Applying the doctrine established by these authorities to the case before us, the facts fail to sustain the charge of negligence on the part of the master. Negligence rests upon a breach of duty, and the record in this case does not show wherein the master failed in the discharge of his duty under the contract embodied in the bill of lading. No question is raised as to his compliance with this agreement to the time the rice was landed on the wharf. The substantial complaint is that the goods were delivered on the wharf more rapidly than they could be removed by the consignee, and that, by reason of this rapid delivery and a failure to properly separate the goods, the removal of the rice was delayed, in consequence of which it was injured by the rain. The evidence shows that the consignee had ample notice of the time and place at which the steamer would begin to unload. It further shows that he made inadequate preparations for the removal of the goods. At 8 o'clock a. m. he had but two drays at the wharf, and that they had removed 40 bags of rice before the rain; that the consignee had ordered a number of additional drays, but these failed to appear until too late to remove the rice before it was injured. The consignee was told by the agent of the railroad company, at the wharf of which the vessel was unloading, that he could use the granary at the shore end of the wharf to store his rice for protection in the event of rain. Of this shelter he made no effort to take advantage. The evidence does not show that the unloading on the wharf was unusually rapid and such that the master should have known that the consignee could not take proper care of the goods after delivery from the ship's deck. If the consignee, who knew his resources for removing the goods, believed they were being landed so rapidly as to delay him in their removal and in taking proper care of them, it was manifestly his duty to inform the master of that fact, in order that the goods might be discharged in a manner not to embarrass the consignee in their removal.

As to the mutual duties of the consignee and the master, Justice Clifford said in *Salmon Falls Manufacturing Company* v. *The Bark Tangier*, 1 Clifford, 396, 5 Myer's Federal Decisions, 385, Fed. Cases No. 13743: "Consignees and masters of vessels are expected to cooperate in the delivery of consignments; and if they do so, it will seldom happen that any controversy will arise; and, when they do not do so, the delinquent party must abide the consequences." The master can not be presumed to know the facilities of the consignee for removing his goods. That is a matter over which he has no control, nor does the law make it his concern. He could not order one dray more or less, nor in anywise control the removal of the goods from the wharf to the store of the consignee. The *Santee*, 5 Myer's Federal Decisions, page 410. For him to have undertaken to interfere in any way in the transportation of the goods from the wharf would have been to go beyond the obligations of the contract which fixed his responsibility as a carrier, and an unwarranted interference in a matter that was entirely under the control of the consignee, and with which he alone was concerned. The consignee knew his resources for removing his goods. The same observation may be made on the failure of the consignee to object to the goods being landed on an open wharf, or to the time of the landing or the conditions of the weather. Had the master persisted, after objections by the consignee, in landing the goods in such way as to likely result in their damage, the ship might have been held liable therefor. The *Grafton*, 1 Blatchford, 173; Fed. Cases No. 5655, 5 Myer's Federal Decisions, 365.

The consignee being present, acquiescing in the time, the place, and method of discharge, receiving the goods according to the special contract of lading, he thereby accepted them, and the master was relieved of further responsibility for their preservation. They had passed from the custody of the master by actual, not constructive, delivery, to the custody and control of the consignee. They were in his custody when damaged, and the loss can not be thrown on the ship.

As to the finding of the district court that the master was negligent in landing the rice in the face of a threatened storm, we have stated the evidence on which the district court rested this conclusion. It consists of the facts that on each of the preceding days there had been light showers; that of the 21st being less than one-hundredth of an inch, "a mere trace;" the prediction of the Weather Bureau, published in a Charleston newspaper and posted at about fifty places in the city on the morning the ship began to unload. We are not prepared to give these predictions of the Weather Bureau the character of established facts, the failure to observe which shall constitute negligence in any of the business relations of life. The science of forecasting the weather has not reached the degree of exactness which will justify the court in saying that men in their every day avocations, whether sea-faring men or others, are bound to take notice of and be guided by its local forecasts, and that it is negligence not to observe them. The case is different where storms of great violence and extent, such as frequently occur on our Atlantic coast, and where information of their existence, course, and the probable time at which they will reach designated points, is given by telegraphic communication and by storm signals, which, if brought to the notice of the master, or of which it is his duty to take cognizance, these he would be bound to observe.

It may be questioned if there is anything of which the general public is expected to take cognizance that is less reliable than are the daily weather forecasts to which it is accustomed, and which are brought to its attention by newspaper notices and printed circulars. Were we disposed to give the weather forecasts the weight allowed them by the district judge, there is no evidence that they were brought to the notice of the master. Further, if the master was bound to take notice of the weather predictions, he should only be held liable for not providing against the light showers predicted, against which, as the record shows, the tarpaulins would have afforded sufficient protection for the rice, and not be required to provide against such an unexpected and heavy downpour of rain as that which did the damage, and was not predicted by the local weather notices. Again, the consignee had equal opportunity, at the least, with the master to anticipate the storm, the latter being unacquainted with the English language, the record showing that his deposition in this case was taken through an interpreter.

In our view, the district court should have dismissed the libel, and it is ordered that the same be dismissed, with the costs of this and the district court for the appellant.

THE EVOLUTION OF THE THERMOMETER.

Under the above title the Chemical Publishing Company of Easton, Pa., has just published a small volume by Dr. Henry Carrington Bolton of Washington, Pa., summarizing the results of his personal researches into the history of the development of the modern mercurial thermometer. Since the publication of the Editor's Meteorological Apparatus and Methods, in 1887, two well known German authorities, Dr. E. Gerland and Dr. H. Hellmann, have contributed to our knowledge of the early history of the thermometer. The latter, in his reprints of classic scientific literature, and the former in his history of the art of experimentation in physics, Leipsic, 1899. According to both these authors, as well as the present more extended publication by Bolton, the thermometer, as distinct from the thermoscope, was *not* invented either by Drebbel, about 1608, nor by Porta, 1558, nor by Bianconi, 1617, nor by Leurechon, 1624, but really and truly by Galileo Galilei before he accepted the professorship at Padua, in 1592. Galileo's first instrument seems to have been a crude air thermometer, and probably in this form was used by his pupil Sagredo, whose letters of 1613 and 1615 give many details. Galileo himself speaks of the degrees or

relative temperatures at different places, and Sagredo says that differences of temperature of 100° can be determined; in fact, in one of his letters he says that in the greatest heat of summer his newest thermometer stood at 360°, whereas with a mixture of snow and salt it fell below the extreme cold of winter by about one-third the difference between the extreme atmospheric temperatures of summer and winter. To the present writer it seems most probable that the scale of 360°, used by Sagredo, in 1615, was formed by bending a long narrow glass tube around a graduated circle, or possibly in a spiral around a graduated cylinder, at the lower end of the tube was the bulb filled with a liquid, water or wine, or oil. The Editor believes that some such simple form of the modern liquid thermometer had been suggested to Sagredo by Galileo, so that the pupil speaks of it as the "instrument for measuring heat which you invented, but which I have made in several convenient styles," or again, "which has been improved by me." Dr. Bolton says, on page 30, that "Jean Rey, a physician of southern France, was the first, in a letter of January 1, 1632, to clearly state that he made use of the expansion of a liquid in the bulb of a thermometer." The simple straight thermometer, partly filled with liquid, and sealed at its upper end, was apparently first made by the famous glass blowers of Florence for the use of Ferdinand II, Grand Duke of Tuscany. Dr. Bolton suggests that in this important modification Ferdinand was probably guided by the experiments made by other Florentine savants to show the effects of atmospheric pressure.

In 1642 Galileo died, and in 1657 his pupils were gathered together by Prince Leopold, the brother of Ferdinand II, in an academy known as the Accademia del Cimento. This continued for ten years, and in 1667 the general results of the researches of its members were published by the Prince in classic style. The thermometers used by this academy are known as the Florentine. They simply consisted of a long tube with a spherical bulb at one end and were hermetically sealed at the other. The tube was filled with spirits of wine, because it was more sensitive than water. The coldest temperature of winter corresponded to 20° on the scale and the highest of summer to 80°. The degrees were marked with bits of enamel colored white, black, and green. The alcohol was colored with a solution of kermes or *sanguis draconis*. The principles on which these thermometers were made were certainly understood in Florence in 1641, shortly after which time the Grand Duke Ferdinand had used them when experimenting on the artificial hatching of eggs. About that same time the Duke established a series of meteorological stations, of which we certainly know—

Florence, Pisa, Bologna, Parma, Milan, Innsbrück, and Warsaw. The instruments that were furnished were: Florentine thermometers, Torricelli's barometer, and Ferdinand's hygrometer. These were observed several times daily and records were kept with great fidelity. One of the Italian daybooks, containing sixteen years of observations, was examined by Libri in 1830. The meteorological observations made in Florence from December 15, 1654, to March 31, 1670, were published entire in the introduction to the Archivio Meteorologico Centrale Italiano, Florence, 1858.

The Florentine thermometers were introduced into France by the way of Poland. The Grand Duke Ferdinand had presented some philosophical apparatus to the envoy of the Queen of Poland, and her secretary sent one of these thermometers to the astronometer Ismael Boulliau, in Paris, with the statement that Ferdinand always carried in his pocket a small one, about 4 inches long. It seems likely that this, the first Florentine thermometer seen in England, was brought to the Royal Society in London on the 30th of May, 1663, by the French traveler Monconys, who was visiting the Honorable Robert Boyle, and was brought by him to the meeting of the Royal Society on that date. As late as 1741 Florentine thermometers continued to be used throughout Europe; thus, at Dantzie, in that year, Hanow reported temperatures on the usual Florentine scale, the zero being in the middle of the tube and indicating the average temperature, or about 45° Fahrenheit. In 1730 Réaumur speaks of Florentine thermometers as in common use.

With regard to the Fahrenheit thermometer, Dr. Bolton says:

Daniel Gabriel Fahrenheit was born at Danzig, Prussia, 24th of May, 1686, the son of a well-to-do merchant. After receiving private instruction at home, he attended the gymnasium, but when fifteen years old he had the misfortune to lose both his parents in one day (14th of August, 1701), and was then sent to Amsterdam to enter a business house. There he completed his apprenticeship of four years, but forsook commerce in order to follow his inclination to study physical science and to travel; he became interested in meteorology and acquired great skill in constructing thermometers. In 1714 he visited glassworks in Berlin and Dresden to supervise the manufacture of the tubes for his instruments, and on this journey he called on Professor von Wolf in Halle, as stated.

Returning to Amsterdam he established himself as a maker of philosophical instruments; at that period three distinguished men of science honored Holland, Dr. Hermann Boerhaave, Professor of Medicine and Chemistry in Leyden; Pieter van Musschenbroek, Professor of Mathematics and Physics in Utrecht, and Willem Jacob van's Gravesande, Astronomer and Mathematician at the Hague, and these refer in their writings to Fahrenheit and his thermometers. When he visited England some time prior to 1724, he was well received and honored by election to membership in the Royal Society. Fahrenheit died, unmarried, in the land of his adoption, 16th of September, 1736, at the age of fifty years; he was buried in the Klosterkirche in the Hague.

Fahrenheit's practical work in thermometry began as early as 1706; at first he used alcohol only, but afterwards became famous for his mercury thermometers. In 1709 he sent his instruments to distant places, Iceland and Lapland, and took them in person to Sweden and Denmark. For eighteen years Fahrenheit kept secret his method of manufacture for commercial reasons, but between 1724 and 1726 he published five brief papers in Philosophical Transactions. Many of the experiments date, however, from 1721.

* * * * * * *

Fahrenheit made his thermometers with different scales at different times, commonly known as large, medium, and small scales, their correspondence and values being shown in the following table:

I Large.	II Medium.	III Small.	Corresponding Centigrade.
90°	24°	96°	35.5°
0	12	48	8.8
—90	0	0	—17.8

In No. I the zero was placed at "temperate," as in the Florentine scale; in No. II each space was divided into four equal parts, and these smaller divisions were afterwards taken as degrees, thus forming scale No. III.

Dr. Bolton's book closes with a table showing thirty-five thermometric scales, and a brief bibliography.

A BAROMETER NEEDED IN BALLOON VOYAGES.

From Wiedemann's Beiblätter we translate the following summary of an article by K. T. Fischer, published in Vol. I, 1900, pp. 394–396 of the Physikalische Zeitschrift.

The object of the author was to construct an instrument for measuring atmospheric pressure, proper for use in a balloon, that is not affected by the principal errors that the mercurial and the aneroid are subject to in the balloon. The height of the mercurial column ceases to give a simple measure of the atmospheric pressure as soon as the balloon is in a state of accelerated motion, since the column stands too high or too low according as the acceleration is directed downward or upward, respectively. The indications of the aneroid are much deranged by the uncontrolled elastic reaction of the metallic box. Starting with the three conditions, namely, that the desired barometer shall be (1) independent of the acceleration of the balloon, (2) as sensitive as the mercurial, (3) free from elastic reaction, the author has constructed a barometer that may be best characterized as a cartesian diver, whose weight, assuming a constant temperature of the submerged object, is a function of the gaseous pressure prevailing in its interior and may be used to measure the external air pressure. The barometric body consists of a vessel of glass in the shape of an aräometer; at the end of its stem, 30 cm. long, there is an enlargement which contains an opening below and ends in a sphere filled with mercury. The enlargement is hermetically sealed with respect to the space in the tube of the stem. The enlargement is about half full of water, and when enough mercury is introduced into the sphere to cause the aräometer to sink to a definite position of equilibrium in a vessel filled with water, the position satisfies the condition that the quantity of water displaced by the whole body weighs precisely the same as the aräometer. Since the volume of air in the enlargement varies when the external atmospheric pressure varies, therefore under different pressures the aräometer sinks to different depths in the vessel of water. If we keep the external temperature constant, which is best done by placing the aräometer in water

with ice, then, by means of a scale placed within the stem, the instrument can be used for measuring the pressure of the air. Experiment shows that this barometer fulfils the three above-mentioned conditions.

The object to be attained by Dr. Fischer is one very much desired by all, but as Professor Marvin has remarked, it will be so difficult to keep the water bath at a constant temperature in a balloon, especially when the water freezes at high altitudes, that the above arrangement will be of little value. The uncertainties due to assuming a constant temperature will always be greater than the errors of the aneroid barometer and it seems more rational to labor to bring the pressure boxes of the aneroid to at least as great perfection as the temperature boxes of the Bourdon thermometer.

The arrangement by Fischer would, we think, be inferior to a simple, straight tube, sealed at the top and open below, immersed in a bath of alcohol, glycerine, or other liquid, and having one or two thermometers closely adjoining. The length of the compressed air column, or rather its volume, and the records of the two thermometers give us the means of allowing for the vapor tension of alcohol and the reduction of the air volume to a standard temperature, whence the pressure becomes known. But, of course, in order to attain an accuracy of one one-hundredth inch of barometric pressure, one must know the volume of air to within one three-thousandth part, which implies knowing its temperature to within one-sixth degree Fahrenheit. This seems at first thought easy, but when the balloon is rapidly rising or falling, the expansion or compression of the air within the tube takes place adiabatically, except in so far as heat may be conducted through the glass tube, and this complicates the determination of the temperature.

LECTURES AND INSTRUCTION.

E. W. McGann, Section Director, delivered a lecture on August 22 before the Farmers' Convention at Jamesburg, N. J., on the Weather Bureau and the State weather service and what they are doing for the farmers. He continued the course of lectures on this subject before the farmers' institutes of New Jersey during the autumn and winter, but owing to the poor heating of the halls at Vineland and Hammerston he contracted a severe cold that temporarily incapacitated him from lecturing; his lecture on December 19, at Caldwell, was very well received.

Under date of November 30, Prof. Wm. M. Fulton reports his attendance at farmers' institutes, at New Market, Clarksville, and Fayetteville, Tenn. The entire middle portion of the State was well represented at these institutes and much interest was manifested by the large audiences in the evening as well as by questions during the sessions in the day time. About two thousand farmers were present, and it is believed that the value of the Weather Bureau to farming interests in this State is being greatly enhanced by the discussions at these meetings.

The institutes held at Memphis, Bell Buckle, and at Nashville during December were very well attended, nearly every county in the State was represented.

Mr. David Cuthbertson, local forecast official at Buffalo, N. Y., lectured before the Men's Club of Lewiston, N. Y., on Friday evening, December 14, and again Saturday morning before the Union School of that city, on the work of the Weather Bureau and its relations to the commercial and marine interests.

Mr. S. S. Bassler, local forecast official, Cincinnati, Ohio, writes that the public schools of that city are now informed by telephone of the forecasts of cold waves, high water, and other meteorological matters, so that the information will reach every home in the city through the children in addition to the usual methods of dissemination.

Mr. Bassler delivered the first lecture of the winter course on December 14, for the Alumni Association of the Bellevue, Ky., High School, on the study of meteorology in the public schools. A large audience paid very close attention.

Mr. J. Warren Smith delivered an address on the work of the Weather Bureau at Lerado, Clermont County, Ohio. The lecture was illustrated and apparently well received. Mr. Smith states that he is really unable to comply with all the requests for lectures before the farmers' institutes, but he has no doubt that such work benefits the public.

On September 21 Mr. A. E. Hackett, Section Director at Columbia, Mo., undertook the instruction of a class in meteorology and climatology in the Missouri State University. The class will meet on Thursdays and Saturdays, one hour each day. The instruction in meteorology will be elementary in character and the work in climatology will be confined to a study of the more important climatic features of the several portions of the United States.

Mr. R. Q. Grant, Observer Weather Bureau, gave a lecture on cyclones and weather forecasting in the Science Building at the State College, Lexington, Ky., Monday, December 10.

THE USE OF THE M. W. REVIEW BY TEACHERS.

We have with much interest noted the steady increase in the circulation of the MONTHLY WEATHER REVIEW among the teachers in high schools, academies, and colleges. We understand that this is largely due to the fact that all the newer text-books on physical geography, physiography, and meteorology, and the journals devoted to those subjects make frequent reference to and quotations from the REVIEW. In fact, Prof. Richard E. Dodge, at the head of the department of geography of the teachers' college in Columbia University, in a recent review of Ward's Practical Exercises in Elementary Meteorology, emphasizes the fact "that the MONTHLY WEATHER REVIEW is an essential aid in good teaching." We take it that this means that both the climatological data and the excellent special contributions from our numerous correspondents are highly appreciated by those who are developing a true system of education, based upon the study of nature and not solely on the language and literature, the abstractions and myths of human invention. One can not acquire a broad education except by going outside of books and studying with enthusiasm the world as it really is, not as man imagines it. That education is most valuable which brings us into close contact with nature, animate and inanimate; with living men and women; with the facts and laws of chemistry and physics.

AERIAL VOYAGES BY BALLOONS AND KITES.

The following interesting letter by A. Lawrence Rotch is copied from Science, December 14, Vol. XII, page 930:

The official report just received of the long-distance balloon race from Paris on October 9 changes somewhat the figures on page 799 of Science, which were those furnished to the press. It appears now that Count de la Vaulx and a companion traveled 1,200 miles in 35 hours and 45 minutes in the basket of a balloon containing only 57,000 cubic feet of illuminating gas. They reached a maximum height of 3½ miles, crossed Germany and landed in Russia, as did another of the contestants. This is probably the longest continuous voyage in the air ever made, although it was nearly equaled forty years ago by our countryman, John Wise, who, with two companions, went by balloon

in 19 hours from St. Louis to Jefferson County, New York, a distance of 1,150 miles.

It is evident that under the management of an aeronaut a balloon can be kept longer in the air than an unmanned balloon, but, nevertheless, a balloon of 8,700 cubic feet capacity, carrying only self-recording instruments, which was liberated from Berlin in 1894, after attaining a height of 10 miles, was carried 700 miles to the borders of Bosnia, at a speed of 62 miles an hour. Still more remarkable, in its way, was the flight of a pair of kites last summer from the Royal Aeronautical Institute near Berlin. Five kites, which had lifted self-recording meteorological instruments to a height of 2¼ miles, broke the wire that confined them to the ground and the two upper kites dragged it across the country for nearly 100 miles before they were finally checked, the trailing wire, 2 miles in length, furnished sufficient resistance to keep the kites flying throughout the night.

TRANSATLANTIC WEATHER.

In order to respond more completely to the needs of the shipping interests of the North Atlantic, the Chief of the Weather Bureau has entered into an arrangement with the Meteorological Office at London, Mr. W. N. Shaw, Secretary, by virtue of which the Weather Bureau will receive daily meteorological reports from London, Valencia, Blacksod Point, Malin Head, Stornoway, Sumburgh Head, Paris, Cuxhaven (Hamburg), Lisbon, and Ponta Delgada (Azores). The European observations are taken at 7 or 8 a. m., Greenwich mean time; the observations at the Azores are taken at 9 a. m. It is expected that these records will all be received at Washington, D. C., not later than noon, Greenwich time, or 7 a. m., seventy-fifth meridian time or eastern standard, and will be published daily in connection with the morning map at Washington. This will give steamers about to sail for Europe the latest information as to the condition of affairs on the European coast.

CORRELATION OF WEATHER IN DISTANT LOCALITIES.

Reports from Sydney, New South Wales, give accounts of the most disastrous hurricane in the Island of New Britain within the past twenty-five years. The storm lasted from December 7 to 10 and came after an unusually trying season of drought. The rain and squalls began on the 2d or 3d and increased in force daily until the hurricane and tremendous sea of the afternoon of the 7th. The center of this island lies in latitude south 6°, latitude 150° east of Greenwich; it is therefore about 28° due north of Sydney, Australia. The typhoons or hurricanes of this region are usually moving westward when they pass these islands, and as they circulate in a direction opposite to those of the Northern Hemisphere, they give New Britain heavy east winds when they pass to the north of it, but west winds when they pass to the south of it. The prevailing wind in the winter is north and west, being, in fact, a portion of the northeast trade wind of the northern trade region carried across the equator on its way toward and around Australia. But these winds are feeble and interspersed with many calms. Hurricanes are not nearly so frequent in this region of calms as they are further southeast, in the neighborhood of Caledonia, New Hebrides, Fiji, and Samoa, or to the northwest, in the neighborhood of the Carolines and Phillipines. It would not be surprising if the hurricane here reported were a very slow-moving one, just beginning and growing in the region of calms, before starting off on its travels.

The daily press has been full of accounts of the typhoons in the North Pacific Ocean, beginning with the destructive storms of November 13, at Guam, in which the U. S. S. *Yosemite* was lost, and continuing down to the end of December, with a series of gales and hurricanes on the route between Japan and British Columbia.

The hurricane at Hongkong on November 10 is mentioned on page 558 of this number of the MONTHLY WEATHER REVIEW.

The southern portions of the North Atlantic and North Pacific oceans seem to have been unusually free from cyclonic disturbances. On the other hand, as the passage of storms eastward is accompanied by southerly winds for a considerable distance south and east of the advancing front, therefore, we are not surprised to learn that the Sandwich Islands have been experiencing unusual southwest winds and rain. The special correspondent of the San Francisco, Cal., Chronicle, under date of November 20, at Honolulu, says:

> The severest "kona" that has been experienced for years swept these islands last week. The "kona" is the native name for a storm from the southwest, a direction from which few storms come in this region. In reality, it is a cyclonic disturbance crossing the Pacific, and when its track lies far enough south, it appears here as a southwest wind.
>
> The "kona" of last week was one of the severest that has ever been known. Although there were no actual losses of vessels, the shipping suffered severely. * * * The wind was accompanied by terrific rains. The Oahu Railroad suffered two washouts and a landslide, which disarranged traffic for three days. This is something that never occurred before. * * * On Kanau the flood came in such torrents as to break down a protecting cement wall. * * * On Molokai the torrent came down in such floods that at one time it scooped out a course for itself many feet deep, carrying millions of cubic feet of earth, rock, and boulders in its onrush. On Maui the rain fell at the rate of 4 inches a day for 3 days in succession. The telephone system of the island is in chaos. * * * The whole island of Haleakala seemed a rushing torrent and streams flowed in great volume where there were never known to be any before. Kahului was under water for several days. * * * During the storm on Maui the Iao River overflowed its banks, carrying a raging torrent to the sea.

The correspondent of the Washington Evening Star, Sereno E. Bishop, under date of November 21, 1900, writes as follows from Honolulu:

> The exceptionally hot weather here has been succeeded by unusually heavy rains during the past six weeks. The rain was deluging on the island of Maui; being accompanied by a violent gale, there was some destruction of property. It was more of a storm than has occurred in these parts for many years. You know that our group is absolutely exempt from anything like a hurricane or typhoon, just as we are wholly exempt from the extreme heats of the tropics or of Washington.
>
> It is a pleasure to note the practical success of the wireless telegraph between our islands * * * there seems to be no doubt that by February next we shall enjoy perfect telegraphic communication from Honolulu to Hilo across three sea channels.

Although a terrible storm passed over northern England and southern Scotland, yet here, as in the Pacific Ocean, when storm centers pass by far to the north, southern England experiences the mildest winter weather. Thus, on December 26, a despatch from London says:

> England has one of the greenest Christmases on record, for the weather has been so mild that primroses and corn flowers are abloom as far north as Liverpool and Yorkshire, while Devonshire revels in a subtropical climate and the Isle of Wight is a garden of roses in midwinter. Never have flowers been more abundant in the London market at Christmas time, nor has mistletoe been cheaper. * * * The London sky has been heavily clouded and the air filled with mist, while the weather has been unseasonably warm.

Reports from Nome, Alaska, say that the worst storm of the season as to high wind and heavy surf began October 31 and lasted until after November 3, when the steamer *Oregon* sailed. After the wind had blown from the southeast for sixteen hours, during which time all the vessels in port put to sea, it suddenly veered to the west and the thermometer dropped nearly 30°; the rain changed to snow and hail.

Advices from Dawson and the Yukon Valley state that at

Dawson on the average of the week, January 9–16, the mean temperature was —58°; the minima, —68° at Dawson and —78° at Forty Mile Creek, occurred on the 16th. These are the lowest temperatures on record in that region. From Skagway to Dawson and below, the Yukon is covered with deep snow. From Skagway to White Horse for 100 miles the railroad is blocked and all trains tied up.

On Tuesday, January 22, occurred a great hurricane in northern Norway.

On January 20 Santiago de Cuba reports the severest cold known for many years, viz, a temperature of 60° and dry northerly winds, that bring great discomfort.

On January 6 severe cold weather somewhat suddenly spread over Europe. A blizzard prevailed throughout southern Russia and southern Austria; a bitter easterly wind and gale prevailed on the east coast of Great Britain, frozen harbors and enormous snow drifts impeded traffic on the northern shore of the Black Sea, and violent gales in the Adriatic. Snow fell as far south as Naples, Rome, and Marseilles. The temperature at St. Petersburg and Moscow was unusually low even for those locations.

At Washington up to January 17 and in the Middle Atlantic States generally, the weather has also been remarkably warm, sunny, and entirely free from snow and with very little rain. The paths of our storm centers have passed to the west and north of us, but even those that came quite near gave us remarkably little precipitation, if, indeed, any at all.

If the atmosphere were a so-called perfect gas, namely, without internal friction, and if there were no irregularities on the earth's surface to introduce resistances, we might imagine that all local weathers, such as the diversities enumerated in the above items, are illustrations of the general principle that phenomena could occur in one portion of the globe entirely independent of those in neighboring portions. But this principle of discontinuous motions or surfaces of discontinuity can scarcely apply, except on the smallest possible scale and for very short intervals of time. We can have no doubt but that the larger phenomena of storms and droughts, winds, and calms, have at least a slight relationship with each other no matter where they occur on the globe.

The fact that the distribution of storm paths is the controlling factor, or the index to the general characteristics of the climate of any place, was perhaps first stated by the Editor in a letter suggesting his maps of storm frequency for the years March, 1871, to February, 1873, (published in 1874, in the Statistical Atlas of the United States, by General Walker), and has been more widely recognized since the publication of analogous charts for Europe by Dr. Köppen. It was early recognized that the storm paths vary from week to week, sometimes quite suddenly, and perhaps always inexplicably, as though they depended upon forces or other considerations quite beyond the limits of the daily weather map. Even the study of the daily international charts of the whole Northern Hemisphere has, as yet, simply increased our store of facts without giving us a satisfactory insight into the mechanism of the process. When the Editor compiled his Preparatory Studies in 1889 his idea was that the temperature and moisture of the lower layers of inflowing, ascending air must determine the formation of cloud and rain, the evolution of latent heat, the interception of the sunshine from above and the radiation from below; that, consequently, the local buoyancy of the atmosphere must, therefore, be recognized as the disturbing cause producing storms where we should otherwise have clear and quiet air. Back of this was the great question, why should there be any local air of special warmth or moisture? Why any differences of condition sufficient to start an initial inflow and uprising? From his study of local thunderstorms, Espy had concluded that local heating of special regions by the sunshine might start a sufficient initial ascending current; but the daily weather map had shown that generally speaking this local heating could not explain the origin of the great storm regions of from 100 to 1,000 miles in diameter. It is true that the West Indian hurricanes and the typhoons of the Indian Ocean had occasionally been traced back to very small beginnings, such as might plausibly be considered as due to local heating in the sunshine, but this would not at all apply to the storms whose centers circulate almost around the globe from China eastward over British Columbia, the Great Lakes, and St. Lawrence Valley, the North Atlantic Ocean, Norway, and Northern Russia. It was seen at once that in this region we have especially to do with cold air flowing southward from the Arctic region, and that the differences of buoyancy in the atmosphere are in this case due to air cooled by radiation rather than warmed by insolation, and the precipitation is formed "in consequence of the elevation of masses of warm air above the masses of cold air, which latter flow for example from the extreme northwest southward." (See Bull. Phil. Soc., Washington, D. C., April, 1874, Vol. 1, page 100.)

This cold air probably comes from the upper regions of the Arctic atmosphere, descending by virtue of its own gravity as it cools and pushes southward by centrifugal force along the earth's surface, so that it is not necessary to speak of these storms as originating in the upper atmosphere. In 1890 Hann in his study of the European area of high pressure of November 11–23, 1889, throws doubt upon the idea that an area of high pressure is in reality simply a mass of descending cold air, or that an area of low pressure is a mass of ascending warm air. Consequently there has been a growing conviction that the movements in the upper atmosphere, viz, above the altitude of the cirrus clouds, are in some way responsible for the origin and maintenance of the storms at the earth's surface. It is recognized that these movements in the upper air can best be considered as the result of the general difference of temperature between the equator and the pole, and that they, therefore, belong to what is called the general circulation of the atmosphere. This general circulation must consist of an upper region in which the air flows eastward and northward, and a lower region in which the air flows eastward and southward in the higher latitudes, but westward and southward within 30° or 40° of the equator. The investigation of the peculiarities of this general circulation is a matter that is especially demanding attention from all students of meteorology. From the observational point of view it is of the highest importance to increase the accuracy of our cloud work; to send up and maintain kites at the highest attainable altitude, and especially to send up sounding balloons which can bring back records from an elevation of 40,000 feet, and, perhaps, by perfected construction from 100,000 feet. Moreover, these explorations of the upper air must be conducted over as wide a range of latitude as is any way possible.

On the other hand, from a theoretical point of view, the mathematician must return to his study of the equations of motion and solve them by the introduction of assumptions that represent the actual condition of the atmosphere more closely than do those hitherto made. It seems almost certain that the general circulation as we have defined it can not be represented by any so-called steady motion, but is a

case in which certain steady currents are separated from each other by areas of quasi-discontinuous motion, viz, of steady currents separated by whirls, rolls, vortex rings, cyclonic or anticyclonic vortices, or other forms of discontinuous motion. If these possible discontinuities harmonize with the observed areas of steady wind and pressure, then we shall recognize the precise mechanism by which our storms originate in the general circulation. But it will still, probably, always be true that the development from a modest initial low to a destructive storm depends upon the condensation of the moisture carried by the lower atmosphere.

The method of study by the use of isostaths introduced in The Preparatory Studies and the accompanying tables, which were afterwards published in the Smithsonian Meteorological Tables of 1893, are much improved upon by the use of the isosteres and other details of the method of Bjerknes and Sandström and will, doubtless, be still further improved by the studies now being prosecuted by Professor Bigelow.

NEW METEOROLOGICAL STATIONS NEEDED.

Two parties will be dispatched at an early date by the United States Geological Survey to explore the region in Alaska north of the Yukon River. One of these parties will start from some point on the Koyukuk River, cross over to the shores of the Arctic Ocean, and return by a different route. The other party will proceed from some point on the upper Koyukuk westward to Kotzbue Sound.

In view of the fact that but little is known concerning the meteorological conditions of this region, it is undoubtedly desirable that the necessary instruments should be carried thither, and if possible one or more permanent stations be established. It seems likely that voluntary observers of temperature, rainfall, wind, and weather can be found even in this region. Unfortunately, the demands for apparatus at the regular stations and the steady increase in our home stations, forces the Weather Bureau to decline requests for new stations or explorations in distant regions, as its supply of instruments on hand is generally at a very low ebb and oftentimes quite exhausted. There is no branch of science that is expanding more rapidly than meteorology, and still further expansion in the future is inevitable. The general study of the atmosphere demands at least one good station for every circle of 200 miles in diameter, or say, 30,000 square miles, and the fact that we have perhaps twice as many within the United States simply shows how many local conditions must be provided for and that the Weather Bureau must provide for local peculiarities as well as the general study of the atmosphere.

The great westerly currents that prevail high above the North Pacific Ocean and Alaska have such an influence upon the weather that is brought to America that we shall never fully understand our daily weather map until we appreciate what is going on far to the westward and far above us. It would seem that the nations of the globe must by some international arrangement provide at joint expense for regular meteorological stations on the smaller islands of the Atlantic and Pacific and in the less frequented portions of the continents.

LIGHTNING FROM CLOUDLESS SKIES.

A letter from Mr. A. B. Elmer, Northfield, Mass., referring to page 292–3 of the MONTHLY WEATHER REVIEW for July, says:

The phenomena observed from Newburg, N. Y., as between southeast and east, was observed from here as between south-southwest and south-southeast, and seemed to approximate the same distance. I had supposed it to be a thunderstorm over Long Island or the ocean, rather than a "lightning aurora." The New England Weather Bulletin shows no rain at the voluntary stations in Connecticut that day, and I have not access to the New York State bulletin.

The rest of Mr. Elmer's communication is devoted to the remarkable meteorological phenomena of November 7, 8, and 9. The severe storms that passed over New England on Thursday, November 8, are worthy of a special study, such as can only be attained by the comparison of the reports from many stations. Over a large region warm rain, heavy hail, snow, thunderstorms, and over Narragansett Bay a fine waterspout are only some of the more conspicuous peculiarities. In conclusion, Mr. Elmer says:

Except for the September gale, and a number of frequent thunderstorms, this thunderstorm in November, with a temperature under 62°, which is the usual limit for lightning, is the first unusual meteorological phenomenon since the sudden temperature changes of May, and the high temperatures of October. On May 11, 1900, I observed a minimum temperature of 15.5° and on May 14 a maximum of 95,.5° being a rise of 80° in three days.

LAKE COMMERCE AND INSURANCE.

Prof. H. J. Cox communicates the special report on lake marine losses for the year 1900, compiled by Mr. H. J. Carr, of Chicago, the manager of the Lake Marine News. Mr. Carr says:

Marine underwriters have come out better during the season just closed than during many previous years. The long list of losses comprised mainly vessels that had attained an age which prevented insurance. * * * There were reported in the Marine Insurance Bulletin, during the season of 1900, 502 losses of all kinds, as compared with 569 losses in 1898 and 386 in 1899. * * * The most dangerous parts of the Great Lakes, as shown by the record of losses, lay between Lake Huron and Lake Erie. * * * Taking into comparison the character and age of the ships lost with the new tonnage under construction, the rapid change in the lake marine becomes marked. No more boats like those that have passed away are being built. Practically nothing but steel ships of large size are under construction.

In the navigation of the Great Lakes, the most marked feature during the October storms was the caution displayed by masters in keeping in harbors of refuge. One night 67 boats were sheltered at Harbor Beach, in Lake Huron, and for a week navigation was practically at a standstill, so careful were masters in keeping out of dangerous seas. It was doubtless due to this caution that October, with its cycle of storms, saw so few losses of vessels and lives. Much closer attention was paid to the warnings of the Weather Bureau than ever before. The rapid extension of that service and the construction of warning towers at all important points has added greatly to its efficiency. The next move will be the adoption of wireless telegraphy from many of the warning towers, by which warnings can be passed from the towers to passing vessels.

The above report is written from the point of view of the marine underwriter, but in the Chicago Chronicle of December 12 we find another view of the case, suggested by the fact that a large percentage of the commerce of the lakes is transacted without any marine insurance. The Chronicle says:

The tempests on the lakes have been violent and disastrous to vessel property. In some wrecks the crews and passengers were lost. In fact, the entire season of navigation on the lakes has been remarkable for the number of persons drowned in shipwrecks. The loss of life is greater by 20 per cent than during any recent previous year.

The temptations of vessel owners to defy the winds and waves after the season of navigation should close have been very great. Cargoes more than sufficient to fill all the available vessel room are constantly offered at high rates. This fact applies to both ocean and lake commerce.

On the lake the pressure to get grain cargoes to the seaboard and the pressure to get coal and merchandise from the East before railroad winter rates go soaring upward has caused the employment of every vessel by which shipments could be made. The insurance season expired some time ago. The weather office hourly hangs out danger warnings; but steam and sail craft continue to start out on their perilous voyages. Passengers court the dangers of winter inland and ocean navigation.

During the year the profits of ocean and lake vessel property have been immense. The rates are high after the season of insurance expires. This fact tempts owners and sailors, who get high wages, to improve their opportunities to the utmost.

It would seem that in dangerous weather and after the close of the season for which marine insurance holds good, navigators, emboldened by the additional security that is offered by the Weather Bureau forecasts and warnings, willingly incur great risks. In so doing some make large profits, but many lose all. The community as a whole is not benefited by the loss of life and property. Those who take such risks as are forbidden by the rules of marine insurance may show great enterprise, but may also do more harm than good. They should be very sure that boats and machinery are not merely seaworthy, but storm proof.

THE WEATHER AND THE NEWSPAPERS.

The Editor received from San Francisco, Cal., a copy of the Bulletin of December 30, containing an article commenting severely upon the exaggerated and erroneous sensational articles in the New York papers of Friday, December 14, relative to the severe storm of wind and rain of that date in San Francisco. The Editor was also requested to protest against these absurd fakes that are typical of modern sensational journalism. Such stories certainly do no good to the community at large; they cultivate a taste for sensations and make the real phenomena of nature seem tame and uninteresting; they are analogous to the stories of hobgoblins, giants, ghosts, and other absurdities on which some nurses feed the minds of children. It seems incredible that full grown men and women need such stories and glaring headlines in order to induce them to buy a newspaper that does not really give reliable news. But it is not necessary for the Editor of the REVIEW to rebuke this class of newspapers; it would be a pleasanter duty if, ignoring them, he could recommend such papers as are thoroughly reliable. We have understood that there are some correspondents and news gatherers who can look at facts and write an account of them in well-chosen words of moderation without flights of fancy, and that there are some editors who can put these accounts in print without artistic embellishment in the way of misleading headlines. Newspapers of this character will certainly be preferred and patronized by the great majority of citizens. We have often been assured that proprietors, reporters, and readers all deplore this unhappy feature of modern journalism, and that it is the managing editors who are alone responsible for it.

THE FIRST NATIONAL METEOROLOGICAL CONGRESS OF MEXICO.

This congress was to have been convened in the City of of Mexico on the 1st of November, 1900, under the auspices of the scientific society Antonio Alzate, and to continue its sessions several days. According to the circular of invitation issued by the officers of the society, the governors of the States, the directors of the observatories, institutes and schools, and all persons interested in the physics of the globe were invited to cooperate. The annual dues were to be $5, "in return for which members will receive the proceedings, acts, and memoirs of the congress." The principal points under discussion at this meeting were to be:

1. The selection and installation of the instruments.
2. The hours and methods of observation.
3. The publication of the results.
4. Practical methods for the organization of local meteorogical systems.

The sessions were to have been held in the building of the Alzate Society.

A full report of the proceedings of this meeting is not yet at hand, but the results will be laid before our readers as soon as received.

CHRONOLOGICAL CYCLES.

The use of the chronological cycles in order to ascertain the day of the week or the phase of the moon is almost a lost art because of the abundance of convenient calendars, almanacs, and other sources of information, but as these elements of the calendar are often put into very compact tables, it will occasionally be useful to the student of meteorology to keep in mind the following explanations and rules:

The Dominical letter is determined by giving to the first seven days of the year the letters A, B, C, D, E, F, G. If Sunday falls on the first then the letter is A; if on the second, it is B, and so on through the list. The whole scheme is simply equivalent to saying that the first day of the year falls on a certain day of the week. The golden number was formerly printed in figures of gold. In order to find the golden number, we add 1 to the year and divide by 19, the remainder is the golden number. Thus 2 is the golden number for the year 1901. The golden number simply expresses the fact that the new moon occurs on the 1st, 2d, 3d, 4th, . . . or the 19th day; whence the year is the 1st, . . . or the 19th in the cycle of nineteen years discovered by the old Greek astronomer Meton. In nineteen years the moon returns to almost the same position with regard to the sun and earth that it had at the beginning of that period. The error is only about two hours, so that if there is a full moon or a new moon to-night, there will be one nineteen years hence, as well as at every 19-year interval backward.

Epact signifies the number of days that elapsed between the preceding new moon and the beginning of the year, or the age of the moon on New Year's Day.

RELATIONS BETWEEN SUMMER AND WINTER TEMPERATURES.

According to the Baltimore American Dr. O. L. Fassig has made an interesting statistical investigation of the question whether there is any relation between the temperatures of successive summers and winters, whether, for instance, an extremely hot summer precedes a cold winter. Dr. Fassig has at his command an accurate daily record of weather in Baltimore, Md., from 1817 to the present time, beginning with the records kept by Capt. Lewis Brantz. Having computed the average summer temperature to be 75° and the average winter temperature to be 35° for the whole eighty-two years he finds that there were 22 summers whose average temperature exceeded 75°, and 26 that were appreciably colder than 75°; the remaining 34 summers had average temperatures within one degree of the normal. Of the 22 warm summers 11 were followed by cool winters and 8 by warm winters. Of the 26 cool summers, 12 were followed by cool winters and 10 by warm winters. Of the 34 normal summers, 17 were followed by cold winters and 14 by warm winters.

In general, therefore, this record shows that neither warm nor cold summers have any more relation to the succeeding winter temperatures than have the normal summers or, in general, there is no regular alternation or period in atmospheric temperatures.

ARCTIC AND ANTARCTIC METEOROLOGICAL OBSERVERS.

The following expeditions will start for the Polar regions during 1901:

1. The Zeigler-Baldwin, to be led by Mr. Evelyn B. Baldwin, who lately resigned from the Weather Bureau for this purpose, the funds to be contributed by Mr. William Ziegler, of New York.

2. A Russian expedition, commanded by Vice-Admiral Makaroff, in the *Ermark*, a vessel constructed to push its way through ice 14 feet thick.

3. A Canadian expedition, in charge of Captain Bernier, in the *Scottish King*.

4. A German expedition; plans not yet published.

5. A joint expedition by Dr. Nansen and the Duke of Abruzzi.

6. Peary and his companions will finish the exploration of Grinnell Land and return home.

7. Dr. Robert Stein and his companions will complete the exploration of Ellesmere Land.

8. A relief expedition to Franz Josef Land, under the command of Captain Stoekken, and apparently at the joint expense of Nansen and Abruzzi.

9. Baron Toll will send a party from the Kara Sea eastward along the Siberian coast.

Capt. J. E. Bernier, of Quebec, proposes to travel by the route taken by the wreck of the *Jeannette*, with dogs, reindeers, and sledges, over the ice from the Lena or Bennett Island region. The trip may last two and a half years.

In the Southern Hemisphere, the British and German expeditions will start in August, 1901, and divide the Antarctic regions between them; Nordenskiold for Norway and Arctowski for Belgium and the Argentine Republic; all will be in the field during the greater part of 1901–3. The network of observations "will furnish a thorough knowledge of the meteorology of all that part of the Antarctic and form a most important contribution to the study of the general atmospheric circulation."

TYPHOON OF NOVEMBER 10 IN HONGKONG.

Mr. Rounsevelle Wildman, Consul General at Hongkong, under date of November 30, reports as follows:

Between the hours of midnight and 9 a. m. on Saturday, the 10th of November, this colony was visited by the most disastrous typhoon that it has experienced since 1874. It caused the loss of over 200 lives, some 270 junks and fishing boats in the harbor, and the loss of the government's new dredger, costing £40,000 and the foundering of H. M. S. gunboat *Sandpiper*. The American barque *Benjamin Sewall* broke her cable and drifted on to the Chinese gunboat *Fupo*, carrying away her masts, spars, and boats. The damage to the *Sewall* running ashore was about $10,000. The American barque *State of Maine*, Captain Colcord, was fortunate in being able to save 8 Chinese from a sinking junk alongside. The greatest loss was caused by the sudden veering of the wind at 8 o'clock. The damage to the city was not as great as to the shipping in the harbor, although iron lamp posts and telegraph posts were twisted and bent, and all buildings of a temporary character were blown down and those in process of construction badly damaged. The consular buildings sustained the loss of all the blinds on one side of it and of a large portion of the windows on the other side. The trees and foliage about the grounds were badly wrecked, as they were all over the city.

EQUINOCTIAL STORMS.

Mr. J. T. Probert, Voluntary Observer at Paterson, N. J., reminds us that "a great deal of the dislike to the Weather Bureau comes from ignorance of its true objects and is associated with reliance upon folk-lore and astrology." His own rule is to make monthly reports to be printed in the local papers, and also daily report and special extra articles upon subjects that are at the moment likely to attract attention; he also puts his daily weather map in a public place where it is very closely watched and where he can answer the questions that are asked. "Thus I have made the daily weather map to become a public teacher and the daily and monthly reports a public instructor." Mr. Probert has also shown his enthusiasm in this study of the weather by an article on equinoctial storms, published in the March report of the New Jersey section, from which we make the following abstract:

From my own records I glean the following data, covering a period of ten years, which I consider a fair test, and on only one occasion can a truly equinoctial storm be said to have come. This was one of those unusual storms which happen once or twice in a lifetime; it occurred on the 18th and 19th of September, 1894, and gave the very large rainfall of 7.44 inches in forty-eight hours, while the 20th, 21st, and 22d were clear days. As a better test, and to give as wide a range as possible, I have tabulated the storms, both great and small, where any rain has fallen, for the week preceding, the week of, and the week following the supposed storm week, and as a truer test I have taken the March and the September equinoxes, with number of rainy days, and also the amount in total; leaving out the present year, as it is incomplete without the month of September. The first table is for the spring equinox, and the second, the fall equinox.

March.

Year.	11th to 18th.		18th to 24th.		24th to 31st.	
	Storms.	Rainfall.	Storms.	Rainfall.	Storms.	Rainfall.
		Inches.		*Inches.*		*Inches.*
1899	3	2.25	3	0.76	4	1.55
1898	2	0.23	3	1.45	3	2.50
1897	3	0.96	3	1.01	1	0.29
1896	3	2.88	3	2.34	2	1.24
1895	3	0.80	1	0.08	2	0.25
1894	3	0.27	3	0.77	2	0.47
1893	2	1.16	3	0.85	none.	.....
1892	2	1.14	2	0.31	1	0.22
1891	3	0.86	3	0.95	3	2.70
1890	2	0.81	3	2.34	4	2.54
Total storms and rainfall.	26	11.36	27	10.87	22	11.76

This table most certainly will not sustain the idea of great storms for the March equinox, and I may say that the prevailing wind in March of every year is from the northwest, which does not bear out equinox idea.

Now, let us see how the month of September will be bear out the idea of storms. In this I have taken the same number of days.

September.

Year.	11th to 18th.		18th to 24th.		24th to 31st.	
	Storms.	Rainfall.	Storms.	Rainfall.	Storms.	Rainfall.
		Inches.		*Inches.*		*Inches.*
1899	2	0.96	3	2.01	2	1.50
1898	2	0.30	1	0.77	1	0.03
1897	2	0.05	1	0.07	2	0.84
1896	3	0.74	1	0.30	1	1.29
1895	2	0.39	.....	.....	2	0.50
1894	3	0.84	2	7.44	.....	.....
1893	3	1.48	3	0.21	1	0.45
1892	1	1.80	1	0.11	1	0.02
1891	.....	.....	.....	.....	.....	.....
1890	7	2.96	.....	.....	1	0.40
Total storms and rainfall.	25	9.54	12	10.91	11	5.03

With these facts in view, let any candid mind review the data as here presented, and see if the belief in equinoctial storms is not a popular delusion. I have taken a wider range in time than to have others as a better test than to place the time limit in a space of three or four days, and therefore better to demonstrate the utter falsity of the general idea, and do what I can to help dispel this popular delusion.

WEATHER BUREAU PUBLICATIONS FOR SCHOOL USE.

The Weather Bureau has issued four editions of a chart entitled Description of Cloud Forms. It comprises 11 half-

tone illustrations of the several cloud types, with names and descriptions and tables showing mean heights and velocities.

Through the zealous activity of one or more educational journals, the idea seems to have obtained that copies of these charts can be had for the asking. As a result the Bureau has been flooded with letters from children, apparently many of them yet in the primary grade, who ask for from one to ten copies each.

Although the chart was prepared primarily for the use of Weather Bureau observers, yet copies will be sent to such educators as desire them for school-room work, provided that their applications show that they are teachers of the proper grade. One or two copies should suffice for the use of a whole class, and it is not thought necessary to send them to young pupils, as such.

In general, the Weather Bureau publications are not really useful to teachers and scholars of schools below the grades of high schools, academies, and colleges.

THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Professor of Meteorology.

CHARACTERISTICS OF THE WEATHER FOR DECEMBER.

The month of December, 1900, was not marked by any severe cold waves or by unusually stormy weather. Mean pressure was in excess of the normal over the central Rocky Mountain and Plateau regions, and also in eastern Tennessee, Georgia, the Carolinas, and Virginia. There were no marked cold waves in the eastern part of the country. West of the Mississippi and north of the thirty-fifth parallel temperature was generally in excess of the normal for the season. Over this same region precipitation was markedly deficient, except on the immediate coast of Washington, where there was an excess of 3 to 5 inches. The month as a whole was drier than usual, except along the immediate Gulf coast and from southern Alabama northeastward to the Carolinas. The chief characteristics were, therefore, (1) high pressure over the central Rocky Mountain and Plateau regions, (2) drought on the Pacific coast south of Washington and a general deficiency of rainfall over the major portion of the country east of the Rocky Mountains, (3) high temperatures and a marked deficiency in snowfall throughout the entire Rocky Mountain and Plateau regions.

PRESSURE.

The distribution of monthly mean pressure is graphically shown on Chart IV, and the numerical values are given in Tables I and X.

The distribution of monthly mean pressure for the current month over the western third of the country is typical of that which obtains in winter under clear skies and in dry weather in California, Oregon, Nevada, Arizona, and Utah, and quite generally elsewhere throughout the northern and middle Plateau regions. It is also typical of the conditions which cause high winter temperature from the northern Plateau eastward over the northeastern Rocky Mountain slope and northward over the British Possessions.

It appears that there is a tendency on the part of the highs and lows, which approach the coast of the United States in the neighborhood of latitude 50° north, to cross the Rocky Mountains in higher latitudes some years than in others. The high temperature and deficient rainfall in California and elsewhere on the Pacific coast are due very largely to this shifting in latitude of storms which come from the Pacific.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

The month, as a whole, was warmer than usual, and this is especially true of the country west of the Mississippi River and north of the thirty-fifth parallel of latitude. Over this vast region temperature was uniformly above the seasonal average except in the Great Valley of California, where it was about 2° below the normal. Since the area of negative departures was exactly outlined by the contour of the valley it may be possible that the low temperature noted therein was simply the effect of air drainage on a large scale. The temperature of the air on all sides of the valley was above the normal.

The region of the greatest positive departure was in northern Montana and western North Dakota, where temperatures were from 8° to 10° above the seasonal average throughout the month. Maximum temperatures of 80° and upward were registered in southern Florida, in the Rio Grande Valley, southwestern Arizona, and southern California. The coldest part of the region of observation was in the Red River Valley of the North, when maximum temperatures of less than 40° were registered.

Freezing temperatures were experienced in central and southern Georgia, save on the immediate coast, in western Florida, and very close to the coast line in the State of Texas. The lowest temperatures of the month were recorded in northern Minnesota and in the mountain regions of Wyoming and Colorado.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	30.2	− 0.2	+15.1	+ 1.3
Middle Atlantic	12	36.4	+ 0.1	+23.3	+ 1.9
South Atlantic	10	47.8	− 0.8	+11.8	+ 1.0
Florida Peninsula	7	61.6	+ 0.3	+ 1.2	+ 0.1
East Gulf	7	51.9	− 0.3	+ 4.6	+ 0.4
West Gulf	7	51.4	0.0	+13.9	+ 1.2
Ohio Valley and Tennessee	12	38 3	+ 0.1	+18.8	+ 1.6
Lower Lake	8	30 5	0.0	+17.8	+ 1.5
Upper Lake	9	26 0	+ 1.4	+24.6	+ 2.0
North Dakota	8	19.0	+ 5.1	+41.7	+ 3.5
Upper Mississippi Valley	11	29.9	+ 1.5	+25.6	+ 2.1
Missouri Valley	10	32.2	+ 3.6	+33.8	+ 2.8
Northern Slope	7	31.6	+ 6.7	+39.3	+ 3.3
Middle Slope	6	36.8	+ 1.9	+26.2	+ 2.2
Southern Slope	6	42.8	+ 1.0	+13.0	+ 1.1
Southern Plateau	15	40.7	+ 1.8	+ 9.0	+ 0.8
Middle Plateau	9	31.5	+ 3.6	+21.0	+ 1.8
Northern Plateau	10	30.2	+ 4.5	+24.8	+ 2.1
North Pacific	9	44.8	+ 3.0	+13.6	+ 1.1
Middle Pacific	5	49.0	+ 0.4	+ 8.7	+ 0.7
South Pacific	4	55.4	+ 2.7	+14 3	+ 1.2

In Canada.—Prof. R. F. Stupart says:

The mean temperature of December was considerably above average over the Dominion from Lake Superior westward to British Columbia. From Thunder Bay district to Manitoba the positive departure from average was 4° to 6°, and in western Assiniboia and in Alberta it ranged from 14° at Medicine Hat to 9° at Edmonton. In British Columbia it was as much as 10° on the Upper Mainland and but 5° on Vancouver Island.

Over the larger portion of Ontario the temperature was in excess of the average, 1° to 3°, but in the Ottawa Valley it was just average, and to the eastward of this there was a very general negative departure, ranging from 1° to 3°.

PRECIPITATION.

In but 4 of the 21 geographic districts into which the country has been divided was precipitation equal to or above the normal for the season. These districts were North Pacific coast, East Gulf, Florida Peninsula, and the South Atlantic States. In the remaining districts the precipitation averaged from 4 to as much as 72 per cent of the normal amount. But little rain fell in California, except in the northwestern portion of the State; little or no rain fell in Nevada, Utah, Arizona, New Mexico, Colorado, Wyoming, Montana, the Dakotas, Nebraska, Kansas, Oklahoma, and western Texas. The rainfall in the central valleys was likewise small in amount and not well distributed throughout the month. Reports from the climate and crop sections of the Rocky Mountain States show that there was a very general and marked deficiency in snowfall in these States, and that the amount of snow on the ground in the mountains is much less than for the corresponding month a year ago. The distribution of snowfall is shown by Chart VIII, and the amount on the ground at the end of the month by Chart IX.

HAIL.

The following are the dates on which hail fell in the respective States:

Arkansas, 2, 6, 7, 13, 22. California, 14. Georgia, 2. Kentucky, 7. Mississippi, 19, 22. Missouri, 22, 27. New Mexico, 11. Oklahoma, 19. Oregon, 15, 16, 17, 19, 20, 21, 27, 28, 29, 30, 31. Tennessee, 22. Washington, 16.

SLEET.

The following are the dates on which sleet fell in the respective States:

Arizona, 31. Arkansas, 29, 30. California, 9, 14, 20, 21. Colorado, 22. Connecticut, 6. Delaware, 21, 25. Illinois, 3, 4, 6, 16, 22, 23, 25, 26, 27, 28, 29, 30, 31. Indiana, 4, 5, 14, 18, 24, 27, 30. Indian Territory, 29. Iowa, 3, 6, 16, 22. Kansas, 15, 27, 30. Maryland, 9, 18, 21, 25, 28, 30, 31. Michigan, 4, 5, 18, 23. Minnesota, 16, 17, 22, 23. Missouri, 3, 4, 16, 22, 23, 27, 29, 30. Montana, 12, 18, 25, 30. Nebraska, 3, 5, 7, 14, 15, 16, 22, 23, 27. Nevada, 14. New Hampshire, 4. New Jersey, 21, 28. New Mexico, 29. New York, 4, 5, 7, 9, 13, 23, 26, 27, 30, 31. North Carolina, 3, 4, 21, 26. North Dakota, 1, 3, 22. Ohio, 1, 3, 4, 7, 8, 15, 17, 30. Oklahoma, 31. Oregon, 16, 17, 25, 29, 30. Pennsylvania, 9, 28, 30, 31. South Dakota, 3, 6, 7. Texas, 28, 29, 31. Utah, 9, 20, 21, 26. Vermont, 2, 4, 5 Virginia, 17, 18, 20, 21, 29. Washington, 11, 15, 16, 29. West Virginia, 17, 18, 28, 30. Wisconsin, 2, 4, 5, 6, 17, 23, 24. Wyoming, 9, 10, 20, 21, 26.

In Canada.—Professor Stupart says:

There was a pronounced deficiency of precipitation in nearly all parts of the Dominion; in both Ontario and Quebec the combined snowfall and rainfall was in many districts less than half the average, and at most points near Lakes Erie and Ontario it was scarcely more than quarter the average amount.

In the Maritime Provinces and British Columbia precipitation was also deficient to a marked degree. Reports from Manitoba and the Territories seem to indicate a nearly average snowfall in Manitoba and Assiniboia and a somewhat heavier fall than usual in Saskatchewan.

At the close of the month the ground in all the more southern and western parts of both Ontario and Nova Scotia was either entirely bare of snow or there were but a few patches here and there; all lower levels in British Columbia were also bare.

In Saskatchewan, northern Manitoba, northern Ontario, throughout the Province of Quebec, and in the interior of New Brunswick the covering is very generally over 10 inches, and in many localities it is nearly 20 inches. Over the more southern portions of New Brunswick and in Prince Edward Island and also in southern Manitoba and southern portions of the Northwest Territories there is just about enough snow for sleighing.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	2.18	61	−1.4	− 3.6
Middle Atlantic	12	2.35	72	−0.9	− 8.4
South Atlantic	10	4.59	128	+1.0	− 6.4
Florida Peninsula	7	3.77	147	+1.2	+ 2.5
East Gulf	7	5.44	125	+1.1	+10.3
West Gulf	7	2.29	70	−1.0	+ 1.3
Ohio Valley and Tennessee	12	1.93	55	−1.6	− 7.5
Lower Lake	8	1.46	51	−1.4	− 2.5
Upper Lake	9	0.84	38	−1.4	− 3.7
North Dakota	8	0.24	44	−0.3	+ 2.0
Upper Mississippi Valley	11	0.54	28	−1.4	− 0.5
Missouri Valley	10	0.30	27	−0.8	+ 1.8
Northern Slope	7	0.32	62	−0.2	− 1.5
Middle Slope	6	0.59	60	−0.4	+ 0.8
Southern Slope	6	0.43	30	−1.0	+ 7.8
Southern Plateau	15	0.05	4	−1.3	− 1.6
Middle Plateau	9	0.26	18	−1.2	− 3.9
Northern Plateau	10	1.27	72	−1.5	− 2.0
North Pacific	9	10.41	117	+1.5	− 0.1
Middle Pacific	5	2.40	43	−3.2	− 4.4
South Pacific	4	0.15	5	−2.9	− 3.4

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.7	−0.1	Missouri Valley	5.2	+0.1
Middle Atlantic	5.5	+0.1	Northern Slope	4.8	+0.2
South Atlantic	5.1	+0.4	Middle Slope	4.1	+0.1
Florida Peninsula	6.3	+1.7	Southern Slope	2.6	−1.8
East Gulf	5.6	+0.4	Southern Plateau	1.6	−1.4
West Gulf	4.9	−0.4	Middle Plateau	4.4	−0.7
Ohio Valley and Tennessee	5.9	−0.2	Northern Plateau	7.6	+0.5
Lower Lake	8.0	+0.4	North Pacific Coast	7.7	+0.4
Upper Lake	7.6	+0.5	Middle Pacific Coast	5.7	+0.3
North Dakota	5.1	−0.1	South Pacific Coast	3.8	−0.6
Upper Mississippi	5.6	−0.1			

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	76	+ 1	Missouri Valley	74	− 1
Middle Atlantic	75	+ 1	Northern Slope	69	+ 2
South Atlantic	78	− 1	Middle Slope	63	− 2
Florida Peninsula	83	+ 1	Southern Slope	54	−13
East Gulf	76	− 2	Southern Plateau	39	− 9
West Gulf	76	+ 3	Middle Plateau	63	− 4
Ohio Valley and Tennessee	76	+ 1	Northern Plateau	83	+ 2
Lower Lake	76	− 2	North Pacific Coast	87	− 1
Upper Lake	84	+ 3	Middle Pacific Coast	80	− 4
North Dakota	81	+ 2	South Pacific Coast	66	− 8
Upper Mississippi	80	+ 4			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Baker City, Oreg	21	50	sw.	Helena, Mont	13	52	sw.
Block Island, R. I	4	84	e.	Mount Tamalpais, Cal.	21	55	nw.
Do	5	60	w.	Do	27	55	nw.
Do	9	55	nw.	Nantucket, Mass	4	60	e.
Boston, Mass	5	60	e.	Do	5	61	w.
Buffalo, N. Y	8	64	sw.	New York, N. Y	4	72	e.
Do	9	67	w.	Do	5	60	nw.
Do	13	59	w.	Do	9	60	nw.
Do	24	52	sw.	Do	13	54	nw.
Carson City, Nev	14	50	sw.	Point Reyes Light, Cal.	29	54	nw.
Do	16	59	sw.	Portland, Me	4	54	ne.
Chicago, Ill	23	52	sw.	Do	5	51	ne.
Eastport, Me	4	52	e.	Winnemucca, Nev	14	58	sw.
Do	5	62	ne.				

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table VII, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 261 thunderstorms were received during the current month as against 167 in 1899 and 976 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 22d, 51; 23d, 44; 27th, 28.

Reports were most numerous from: Arkansas, California, Illinois, and Missouri, 24; Georgia and Oregon, 23.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, 2d to 10th.

In Canada.—An aurora was reported at Calgary and Prince Albert on the 27th.

DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Professor of Meteorology.

For description of tables and charts see page 453 of REVIEW for October, 1900.

TABLE I.—*Climatological data for Weather Bureau Stations, December, 1900.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m.+8 p. m.÷2.	Mean reduced.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							30.2	— 0.2								76	2.13	— 1.4										5.7		
Eastport	76	69	74	29.88	29.97	.00	34.6	— 0.9	45	24	30	— 2	10	19	30	23	19	79	2.82	— 1.2	11	8,128	w.	62	ne.	5	8	9	14	6.8	21.8
Portland, Me	103	81	117	29.88	29.99	— .03	27.0	— 0.4	47	24	34	0	10	20	29	23	19	76	2.38	— 1.1	5	5,956	sw.	54	ne.	4	9	14	8	5.1	7.1
Northfield	876	15	65	29.05	30.06	+ .01	18.7	— 2.7	50	23	28	—15	18	9	37	16	14	83	1.34	— 1.7	11	5,102	s.	38	sw.	9	4	14	13	6.7	12.0
Boston	125	115	181	29.89	30.03	— .01	33.4	+ 2.3	59	24	41	8	10	26	26	30	25	73	2.25	— 1.2	6	8,159	sw.	60	e.	5	10	9	12	5.6	0.8
Nantucket	12	43	85	30.03	30.04	— .01	37.2	+ 0.8	56	4	42	15	10	32	26	34	29	74	1.88	— 2.4	12	11,154	nw.	61	w.	5	6	8	17	7.1	4.1
Block Island	26	11	70	30.02	30.05	.00	35.8	— 0.4	57	4	41	16	*	30	22	33	27	70	2.47	— 1.2	8	14,227	w.	84	e.	4	12	12	7	4.4	0.9
Narragansett	.....	10	....	.....	.....	.....	32.4	— 0.4	55	*	41	9	15	24	29	....	....	....	2.20	— 1.5	6	.....	w.	....	.....	...	21	3	7	...	0.5
New Haven	106	117	140	29.94	30.06	— .02	32.6	+ 0.4	57	24	40	7	17	25	28	29	25	75	2.14	— 1.3	7	6,648	sw.	42	ne.	4	8	15	8	4.8	1.0
Mid. Atlan. States.							36.4	+ 0.1								75	2.35	— 0.9										5.5		
Albany	97	84	113	29.97	30.08	+ .01	28.6	0.0	55	24	36	2	18	21	29	26	22	80	1.80	— 0.9	8	5,315	s.	26	w.	9	8	9	19	7.4	1.5
Binghamton	875	79	90	.....	.....	.....	27.8	— 0.7	50	24	34	0	15	21	36	.	....	....	1.40	— 1.4	12	4,374	w.	27	w.	24	8	5	23	8.1	6.2
New York	314	108	350	29.74	30.09	.00	35.2	+ 0.8	56	24	41	12	15	30	23	31	25	68	1.98	— 1.3	6	11,253	nw.	72	e.	4	15	7	9	4.8	0.5
Harrisburg	374	94	104	....	....	.....	34.0	— 0.4	54	24	40	12	15	28	25	....	....	....	1.62	— 1.4	6	5,369	w.	36	w.	9	9	7	15	5.9	0.8
Philadelphia	117	168	184	29.99	30.12	.00	36.6	+ 1.1	59	24	43	12	15	30	25	32	27	70	2.41	— 0.3	8	6,897	nw.	31	nw.	5	11	8	12	4.9	1.8
Scranton	805	111	119	29.20	30.11	.....	30.8	.....	53	24	38	5	14	24	30	28	25	85	2.61	.....	8	5,995	sw.	42	nw.	9	5	10	16	7.1	3.5
Atlantic City	52	68	76	30.05	30.11	+ .02	37.0	+ 0.6	57	4	44	14	17	30	24	34	29	76	2.76	— 1.1	5	7,889	nw.	42	nw.	4	11	15	5	4.6	13.1
Cape May	17	47	51	30.11	30.13	+ .03	37.8	— 0.1	55	4	44	14	15	32	26	35	...	....	2.88	— 1.5	7	6,262	nw.	33	w.	5	12	14	5	4.9	9.0
Baltimore	123	68	82	29.98	30.11	— .01	37.2	— 0.3	62	19	44	15	15	30	29	33	28	75	2.07	— 1.1	7	3,450	w.	24	w.	5	8	12	11	5.9	T.
Washington	112	50	76	30.01	30.13	— .01	36.5	+ 0.3	62	24	45	15	17	28	34	31	26	72	2.52	— 0.5	8	4,231	nw.	36	nw.	5	15	5	11	4.6	0.2
Cape Henry	.....	5	33	.....	.....	.....	43.3	— 0.6	70	4	51	26	15	36	30	....	....	....	3.42	— 0.4	9	9,603	sw.	49	nw.	21	12	11	8	4.9	T.
Lynchburg	681	83	88	29.37	30.13	— .01	39.7	+ 0.4	63	19	49	18	17	30	32	34	29	75	3.10	0.0	9	2,457	sw.	24	nw.	5	14	11	6	4.5	3.2
Norfolk	91	102	111	30.04	30.14	+ .02	43.2	+ 0.4	70	4	51	24	17	35	28	39	35	77	2.25	— 1.4	8	6,636	n.	36	se.	4	14	8	9	4.7	T.
Richmond	144	82	90	.....	.....	.....	40.3	... ..	64	24	49	19	15	31	29	....	....	....	2.60	.....	5	3,587	n.	20	nw.	5	12	11	8	4.9	7.2
S. Atlantic States.							47.8	— 0.3								78	4.59	+ 1.0										5.1		
Charlotte	773	68	76	29.29	30.14	.00	42.6	— 1.0	62	23	51	25	15	34	28	38	32	71	4.33	+ 0.2	9	4,482	ne.	24	ne.	21	15	6	10	4.5	T.
Hatteras	11	17	36	30.12	30.13	+ .02	48.0	— 0.2	71	4	53	30	17	43	29	45	43	84	3.33	— 2.1	9	11,237	n.	44	w.	4	15	9	7	4.5	
Kittyhawk	8	12	30	.....	.....	.....	45.4	— 0.8	70	4	52	24	17	39	20	....	....	....	3.76	— 0.4	7	10,722	ne.	....	....	...	16	7	8	4.4	
Raleigh	376	93	101	29.74	30.15	+ .01	42.7	— 1.2	70	23	52	21	17	34	29	37	32	71	3.75	+ 0.6	9	3,894	n.	26	n.	21	14	7	10	4.6	T.
Wilmington	78	82	90	30.05	30.14	+ .01	47.1	— 1.2	72	4	57	23	17	38	30	42	39	80	5.69	+ 2.7	9	5,675	n.	35	w.	4	11	9	11	5.2	
Charleston	48	14	92	30.10	30.15	+ .02	50.9	— 0.6	70	4	58	33	16	44	22	46	42	77	4.65	+ 1.4	10	7,727	n.	34	w.	4	7	13	11	5.7	
Columbia	.....	5	....	.....	.....	.....	51.9	— 0.5								76	5.44	+ 1.1										5.6		
Augusta	46.2	— 2.3	70	23	57	27	16	36	33	...	....	....	6.17	+ 3.2	11	.....	nw.	....	.....	...	12	9	10	5.2						
Macon	370	93	99	.....	.....	.....	47.2	.....	65	23	56	29	16	38	31	....	....	....	5.89	.....	10	4.163	nw.	24	nw.	25	5	16	10	5.6	
Pensacola	56	78	90	.....	.....	.....	55.2	+ 0.7	73	23	62	36	9	48	21	.....	.....	....	7.74	+ 3.8	10	5.786	ne.	30	sw.	30	12	9	10	5.1	
Mobile	57	88	96	30.07	30.14	+ .01	52.8	+ 0.4	70	23	61	34	9	44	28	48	44	80	4.74	+ 0.3	12	4.875	n.	23	sw.	22	10	8	13	5.8	
Montgomery	223	100	112	29.90	30.14	— .01	49.4	— 0.2	68	23	58	32	9	41	29	44	40	77	5 00	+ 0.3	10	4.474	e.	26	s.	28	8	8	15	6.0	
Meridian	375	84	98	.....	...	.....	48.2	— 2.3	67	22	58	27	9	38	33	....	....	....	3.32	— 1.6	11	3,807	n.	26	s.	28	10	7	14	5.7	
Vicksburg	247	65	76	29.84	30.12	— .03	50.6	0.0	71	22	59	34	9	42	26	44	39	72	2.12	— 2.8	10	4,887	n.	27	s.	22	14	5	12	5.0	
New Orleans	51	88	121	30.07	30.13	+ .03	55.6	+ 0.1	74	22	63	42	10	49	24	51	47	80	5.61	+ 1.2	7	5,672	ne.	39	n.	28	8	8	15	6.4	
Port Eads	.....	27	...	.....	.....	.....	58.1	— 1.4	73	2	65	44	25	51	24	...	...	....	8.25	+ 4.8	15	.....	ne.	...	.....	...	5	8	18	....	
West Gulf States.							51.4	0.0								76	2.29	— 1.0										4.9		
Shreveport	249	77	84	29.86	30.14	+ .01	50.0	+ 0.5	73	22	59	32	9	41	30	44	39	75	1.48	— 3.2	4	4,981	s.	28	nw.	19	13	5	13	5.1	
Fort Smith	457	79	94	29.62	30.12	— .01	45.8	+ 3.0	70	17	56	22	31	36	34	39	33	69	1.22	— 1.9	4	6.091	e.	38	w.	22	13	3	15	5.1	T.
Little Rock	357	93	100	29.74	30.13	— .01	46.3	+ 1.3	69	22	56	29	29	37	30	41	38	79	3.34	— 1.0	7	4.789	sw.	30	s.	22	13	8	10	5.0	
Corpus Christi	18	42	50	30.11	30.13	+ .03	57.2	— 2.1	78	22	64	38	29	51	26	53	50	81	2.16	+ 0.8	9	6,449	ne.	30	ne.	31	14	7	10	4.6	
Fort Worth	670	106	114	.....	.....	.....	49.3	.....	76	27	61	19	31	38	34	...	....	....	0.35	.....	1	8,140	sw.	38	nw.	19	20	4	7	3.3	
Galveston	54	106	112	30.05	30.10	.00	56.4	— 0.7	70	22	61	41	4	52	17	53	51	84	5.40	+ 1.4	9	7.110	n.	34	n.	28	10	9	12	5.8	
Palestine	510	73	79	29.59	30.15	+ .02	50.0	— 1.4	74	22	59	30	31	41	30	44	39	73	1.73	— 2.1	4	5.312	sw.	36	sw.	22	13	8	10	5.3	
San Antonio	701	67	77	29.39	30.15	+ .04	54.1	— 0.8	76	22	65	34	*	43	36	46	41	74	0.70	— 1.2	4	3,791	n.	33	nw.	19	11	9	11	5.2	
Ohio Val. & Tenn.							38.3	+ 0.1								76	1.93	— 1.6										5.9		
Chattanooga	762	106	112	29.34	30.18	+ .02	43.6	0.0	62	18	52	25	12	35	30	38	33	72	2.57	— 1.8	8	4,667	nw.	32	se.	22	13	6	12	5.1	
Knoxville	1,004	10	88	29.07	30.17	— .01	41.7	+ 1.8	62	23	50	23	12	34	26	36	33	79	2.75	— 1.4	10	4.598	sw.	30	se.	23	12	7	12	5.4	T.
Memphis	397	140	154	29.71	30.15	.00	46.8	+ 3.2	67	18	54	28	10	39	25	41	36	72	3.11	— 1.1	10	7,448	s.	37	s.	22	15	4	12	4.4	
Nashville	546	128	134	29.56	30.15	.00	42.8	+ 1.1	65	18	51	24	12	34	28	37	33	73	2.22	— 1.5	8	4,741	s.	38	se.	22	14	8	9	4.6	
Lexington	989	75	102	....	....	.....	37.2	— 0.9	59	18	44	18	10	30	24	....	....	....	1.86	— 1.5	8	7,711	sw.	32	sw.	23	9	10	12	5.6	T.
Louisville	525	114	136	29.55	30.14	— .01	39.1	+ 0.7	61	18	47	20	10	31	29	34	30	74	1.75	— 2.1	9	6,114	sw.	30	sw.	23	10	9	12	5.5	T.
Evansville	434	72	82	.....	.....	.....	39.0	.....	64	22	46	17	31	32	23	....	....	....	1.99	.....	9	5.593	sw.	37	s.	22	15	6	10	4.3	T.
Indianapolis	822	154	164	29.20	30.12	.00	32.9	— 0.2	56	22	40	14	31	26	28	29	25	74	1.41	— 1.7	7	7,952	s.	38	sw.	23	5	11	15	6.5	3.6
Cincinnati	628	152	157	29.44	30.15	+ .01	35.4	— 1.2	56	22	43	18	14	28	28	32	28	76	1.01	— 2.1	9	5,422	se.	30	sw.	23	9	8	14	6.4	0.1
Columbus	824	87	100	29.22	30.14	+ .02	32.5	— 0.8	56	23	38	13	16	26	22	30	26	81	0.92	— 2.0	10	5,642	sw.	26	sw.	23	6	9	16	7.0	0.5
Pittsburg	842	116	123	29.18	30 12	.00	34.7	— 0.3	61	23	41	11	15	28	28	31	26	73	1.99	— 0.9	13	4,787	nw.	24	nw.	31	6	5	20	7.2	7.7
Parkersburg	638	77	84	29.46	30.18	+ .03	35.0	— 2.0	60	22	42	14	15	28	32	32	29	82	1.67	— 1.6	11	3,721	sw.	24	nw.	9	5	5	21	7.6	0.1
Elkins	1,940	41	50	28.02	30.15	.....	31.6	.....	58	22	40	6	17	23	41	28	25	83	3.05	.....	13	3,512	w.	29	s.	23	5	8	18	7.2	2.9
Lower Lake Region.							30.5	0.0								76	1.46	— 1.4										6.0		
Buffalo	767	178	206	29.19	30.06	+ .01	31.4	+ 1.6	53	22	37	4	14	26	31	28	23	72	1.26	— 2.1	17	13,212	w.	67	w.	9	0	3	28	9.1	7.1
Oswego	335	76	87	29.66	30.05	.00	28.1	— 1.3	50	3	34	1	14	22	29	26	23	84	3.70	+ 0.3	22	8,753	se.	43	nw.	9	2	5	24	8.5	22.1
Rochester	523	81	90	29.46	30.05	.00	29.1	+ 0.5	54	22	35	5	14	23	29	27	23	78	2 96	0.0	18	6,135	sw.	32	nw.	9	0	5	26	9.2	20.3
Erie	713	92	102	29.28	30.08	+ .02	32.2	— 0.2	57	23	38	8	15	27	22	29	25	78	1.06	— 2.2	12	9,521	sw.	39	nw.	9	0	9	22	7.8	5.7
Cleveland	762	190	201	29.24	30.10	+ .02	31.8	+ 0.6	56	23	37	15	12	26	28	28	22	69	0.81	— 1.8	12	12,497	sw.	48	nw.	9	4	5	22	8.0	7.6
Sandusky	629	62	70	29.39	30.10	+ .01	31.6	— 0.9	58	3	37	13	29	26	21	29	24	75	0.69	— 1.8	9	6,226	sw.	28	nw.	9	2	8	21	8.1	4.6
Toledo	628	123	127	29.39	30.10	+ .02	30.2	— 0.5	56	3	36	10	14	24	21	28	24	77	0.78	— 1.6	9	7,718	sw.	35	sw.	23	7	6	18	7.1	3.9
Detroit	730	160	190	29.26	30.08	+ .01	29.3	— 0.2	52	3	35	11	14	24	21	27	23	79	0.42	— 2.2	7	9,457	sw.	48	sw.	23	7	7	17	6.6	2.0
Upper Lake Region.							26.0	+ 1.4								84	0.34	— 1.4										7.6		
Alpena	609	63	80	29.33	30.02	— .01	26.0	+ 1.2	44	23	31	— 3	16	21	27	24	22	86	0.57	— 1.9	13	8,203	nw.	46	nw.	9	3	3	25	8.2	6.0
Escanaba	612	43	57	29.32	30.02	— .01	24.1	+ 2.7	41	22	29	— 1	31	19	21	23	21	91	0.76	— 1.2	5	7,115	sw.	36	nw.	8	2	7	22	8.2	2.6
Grand Haven	632	55	92	29.34	30.05	+ .01	30.8	+ 1.2	50	22	36	7	14	26	21	28	26	84	0.57	— 2.1	10	10,993	nw.	46	sw.	23	3	8	20	8.0	3.3
Houghton	668	66	74	.....	.....	.....	22.6	.....	41	23	29	— 2	31	16	33	...	....	....	2.03	.....	17	5,704	nw.	36	nw.	8	2	6	23	8.3	16.4
Marquette	734	79	116	29.16	30.00	— .03	24.4	+ 1.6	42	22	28	— 1	31	20	22	23	22	90	1.83	— 0.6	19	8,597	nw.	44	sw.	8	0	7	24	8.8	15.6
Port Huron	638	70	120	29.37	30.09	+ .03	28.8	+ 1.0	51	*	34	8	14	24	26	26	23	81	0.34	— 2.0	8	9,533	sw.	46	nw.	9	5	11	15	6.9	4.1
Sault Ste. Marie	614	40	61	29.28	29.98	— .02	22.6	0.0	41	22	29	— 7	14	17	30	21	19	87	1.61	— 0.5	13	7,075	se.	49	nw.	8	3	4	24	8.5	12.8
Chicago	823	241	274	29.16	30.09	+ .02	30.0	+ 0 7	53	22	36	2	31	24	30	28	24	80	0.58	— 1.8	7	13,319	w.	52	sw.	23	7	11	13	6.4	3.6
Milwaukee	681	124	142	29.30	30.07	.00	28.9	+ 3.3	48	2	35	— 1	31	23	35	26	23	81	0.84	— 1.1	9	8,584	w.	37	sw.	23	11	8	12	5.4	7.4
Green Bay	617	49	57	29.35	30.06	.00	24.6	+ 0.8	46	22	31	— 1	31	18	24	23	19	78	0.63	— 1.9	9	6,968	w.	34	w.	8	3	6	22	8.0	4.2
Duluth	702	95	115	29.23	30.04	— .04	19.6	+ 1.8	42	18	26	—17	31	13	40	18	15	82	0.65	— 0.7	8	7,072	sw.	48	nw.	23	5	11	15	6.6	5.7
North Dakota.							19.5	+ 6.3								81	0.29	— 0.3										5.1		
Moorhead	935	54	60	29.01	30.10	— .05	16.2	+ 4.3	38	20	24	—13	31	8	39	15	14	93	0.54	— 0.2	11	8,638	nw.	40	se.	15	7	11	13	6.1	4.8
Bismarck	1,674	16	29	28 24	30.12	— .03	21.4	+ 6.7	52	21	31	— 8	31	12	46	17	10	66	0.11	— 0.5	4	7,217	nw.	37	nw.	8	14	7	10	4.8	0.9
Williston	1,875	15	31	28.00	30.10	— .07	21.0	+ 8.0	46	21	30	—10	31	12	42	19	17	84	0.21	— 0.5	7	6,381	n.	38	w.	17	15	13	3	4.4	1.6

TABLE I.—*Climatological data for Weather Bureau Stations, December*, 1900—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Elevation of instruments: Thermometers above ground.	Elevation of instruments: Anemometer above ground.	Pressure, in inches: Mean actual, 8 a. m. +8 p. m. +2.	Pressure, in inches: Mean reduced.	Pressure, in inches: Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. +, mean min. +2.	Temperature: Departure from normal.	Temperature: Maximum.	Temperature: Date.	Temperature: Mean maximum.	Temperature: Minimum.	Temperature: Date.	Temperature: Mean minimum.	Temperature: Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Precipitation, in inches: Departure from normal.	Precipitation, in inches: Days with .01, or more.	Wind: Total movement, miles.	Wind: Prevailing direction.	Wind: Maximum velocity: Miles per hour.	Wind: Maximum velocity: Direction.	Wind: Maximum velocity: Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Upper Mis. Valley.							29.9	+ 1.5										80	0.54	— 1.4									5.6	
Minneapolis	.....	99	108	.....	.....	.....	21.0	+ 0.9	44	22	28	—12	31	14	35	....	....	....	0.37	— 1.1	8	8,898	nw.	42	nw.	8	4	14	13	....	4.3
St. Paul	837	114	124	29.11	30.08	— .03	21.7	+ 2.9	42	18	28	—10	31	16	33	20	18	84	0.47	— 0.8	7	6,657	nw.	34	nw.	8	7	11	13	6.3	2.5
La Crosse	714	70	78	.....	.....	.....	24.6	+ 1.0	48	22	30	— 3	31	19	26	....	....	....	0.33	— 1.1	10	5,755	s.	36	nw.	8	7	5	19	6.8	3.0
Davenport	606	71	79	29.40	30.10	— .02	29.4	+ 1.6	53	22	36	0	31	23	27	26	23	80	0.21	— 1.5	4	6,288	w.	29	sw.	23	13	6	12	5.7	0.5
Des Moines	861	84	88	29.15	30.14	.00	28.6	+ 1.8	54	21	37	— 2	31	20	30	26	23	82	0.35	— 1.1	7	5,884	nw.	28	sw.	29	7	9	15	6.5	3.0
Dubuque	698	101	109	29.30	30.10	.00	27.4	+ 1.5	51	22	34	— 3	31	21	27	25	22	84	0.42	— 1.4	8	6,047	w.	38	nw.	9	9	8	14	6.2	2.4
Keokuk	614	63	78	29.43	30.12	.00	31.4	+ 1.6	57	21	38	7	31	25	31	28	24	80	0.25	— 1.7	4	5,756	nw.	48	w.	23	16	2	13	4.5	0.5
Cairo	356	87	93	29.74	30.14	+ .01	41.0	+ 1.8	62	18	48	22	31	34	26	36	32	73	2.43	— 0.9	8	6,550	s.	38	w.	22	10	11	10	5.3	
Springfield, Ill.	644	82	93	29.40	30.12	— .01	32.4	— 0.4	59	2	39	9	31	26	27	29	25	75	0.41	— 2.3	7	7,091	s.	32	sw.	23	11	9	11	5.4	2.6
Hannibal	534	75	110	.....	.....	.....	33.8	+ 1.9	58	22	42	6	31	26	31	....	....	....	0.33	— 1.2	5	6,633	nw.	35	w.	23	14	6	11	4.6	0.5
St. Louis	567	111	210	29.49	30.12	— .01	38.0	+ 2.4	63	2	45	15	31	31	24	34	31	79	0.40	— 2.4	7	7,289	s.	41	sw.	23	12	8	11	5.2	1.7
Missouri Valley.							32.2	+ 5.6										74	0.30	— 0.8									5.2	
Columbia	784	4	84	.....	.....	.....	34.9	— 0.2	63	21	44	6	31	25	36	....	....	....	0.38	— 1.6	7	6,120	sw.	40	sw.	22	13	7	11	5.4	1.4
Kansas City	963	78	95	29.07	30.14	— .02	35.8	+ 3.9	61	21	43	2	31	28	30	32	27	74	0.19	— 1.3	5	6,022	n.	27	n.	27	16	3	12	4.3	0.7
Springfield, Mo.	1,324	100	103	28.67	30.12	.00	38.5	— 0.1	63	17	46	9	31	31	26	34	31	80	0.63	— 2.3	6	7,558	s.	40	sw.	22	13	11	7	4.8	T.
Topeka	.....	81	.....	.....	.....	.....	35.7	+ 0.9	60	17	45	2	31	27	32	....	....	....	0.21	— 0.8	5	.....	nw.	....	.....	...	11	11	9	4.6	1.0
Lincoln	1,189	75	84	28.78	30.11	— .04	33.6	+ 3.2	68	17	43	0	31	24	36	28	23	72	0.49	— 0.2	5	8,020	n.	45	nw.	23	14	6	11	5.0	1.9
Omaha	1,105	115	121	28.87	30.10	— .07	32.2	+ 5.5	63	17	40	— 2	31	24	32	28	24	78	0.46	— 0.6	6	6,557	nw.	36	n.	9	13	6	12	5.4	3.4
Valentine	2,598	39	40	27.29	30.11	— .05	32.1	+ 4.9	64	20	44	—12	31	20	42	26	20	72	0.15	— 0.2	4	8,028	w.	46	nw.	23	14	7	10	5.4	0.6
Sioux City	1,135	96	164	.....	.....	.....	28.2	+ 4.1	56	20	35	— 5	31	21	33	....	....	....	0.35	— 0.8	5	9,342	nw.	43	nw.	23	11	8	12	5.7	2.5
Pierre	1,572	43	50	28.37	30.12	— .05	29.6	+ 4.9	54	20	40	— 4	31	20	39	24	18	68	0.31	— 0.1	9	5,489	nw.	37	nw.	30	9	11	11	5.4	1.7
Huron	1,306	56	67	28.63	30.11	— .07	24.8	+ 5.6	57	21	36	—12	31	14	38	20	16	74	0.06	— 0.5	2	8,714	nw.	36	nw.	22	12	6	13	5.7	0.4
Yankton	1,233	52	58	.....	.....	.....	29.0	+ 6.5	59	20	39	— 7	31	19	36	....	....	....	0.09	— 0.7	2	6,600	nw.	38	nw.	22	11	9	11	5.5	0.9
Northern Slope.							31.6	+ 6.7										69	0.32	— 0.2									4.6	
Havre	2,505	46	47	27 34	30.06	— .09	31.5	+10.9	63	7	42	— 4	30	21	42	28	23	74	0.26	— 0.3	6	9,561	sw.	48	sw.	29	11	14	6	4.8	2.3
Miles City	2,371	42	50	27.48	30.08	— .08	30.9	+11.6	58	7	41	— 2	28	21	33	26	24	86	0.10	— 0.2	4	5,264	s.	36	sw.	1	18	10	3	3.3	0.3
Helena	4,110	88	93	25.85	30.17	.00	32.8	+ 7.5	58	6	40	— 8	31	26	29	28	21	64	0.43	— 0.5	5	5,728	sw.	52	sw.	13	5	11	15	6.4	0.9
Kalispell	2,965	45	51	27.00	30.19	+ .04	31.2	.....	50	20	36	—10	31	26	22	29	27	88	0.88	.....	9	3,122	w.	31	sw.	16	2	6	23	8.5	5.2
Rapid City	3,234	46	50	26.61	30.06	— .11	33.8	+ 3.6	58	21	45	— 7	31	23	32	28	21	65	0.14	— 0.1	3	6,559	nw.	36	nw.	6	17	12	2	3.7	1.3
Cheyenne	6,088	56	64	24.00	30.22	+ .07	31.7	+ 3.2	58	9	43	—18	31	20	41	24	9	46	0.33	— 0.0	5	10,119	nw.	49	nw.	1	14	15	2	3.7	3.2
Lander	5,372	28	36	24.69	30.28	+ .11	26.5	+ 3.1	54	6	40	—29	31	13	34	30	15	70	0.90	+ 0.4	3	2,339	sw.	34	sw.	21	15	10	6	3.9	9.0
North Platte	2,821	43	52	27.12	30.18	+ .01	34.0	+ 6.9	66	20	48	—10	31	20	43	25	17	58	0.06	— 0.5	3	6,452	w	42	nw.	6	16	11	4	3.9	0.8
Middle Slope.							36.8	+ 1.9										63	0.59	— 0.4									4.1	
Denver	5,291	79	151	24.76	30.22	+ .06	36.4	+ 4.4	64	8	49	—19	31	23	38	26	9	40	0.42	— 0.2	2	7,241	s.	46	nw.	21	17	10	4	3.5	5.8
Pueblo	4,685	80	86	25.34	30.20	+ .06	34.1	+ 0.4	68	8	51	—15	31	17	54	26	12	48	0.40	— 0.1	5	4,989	nw.	42	w.	21	18	10	3	4.0	4.1
Concordia	1,398	42	47	28.60	30.16	+ .01	35.0	+ 2.0	62	17	44	2	31	26	37	30	27	79	0.73	+ 0.2	6	5,062	s.	30	n.	30	14	6	11	4.7	0.9
Dodge	2,509	44	52	27.46	30.17	+ .03	36.0	+ 3.4	73	17	50	— 6	31	22	47	27	20	65	0.09	— 0.5	3	6,611	nw.	37	nw.	22	22	6	3	3.1	0.6
Wichita	1,358	78	85	28.66	30.15	+ .04	37.2	— 0.7	62	1	46	5	31	28	29	31	26	73	0.73	— 0.2	2	6,020	n.	30	n.	30	12	8	11	4.9	0.2
Oklahoma	1,214	54	62	28.80	30.14	+ .08	41.8	+ 1.7	66	21	52	10	31	31	34	36	31	73	1.15	— 1.3	3	7,307	s.	31	nw.	30	14	8	9	4.6	
Southern Slope.							43.5	+ 1.6										54	0.18	— 1.0									2.6	
Abilene	1,738	45	54	28.28	30.15	+ .01	47.8	+ 0.3	70	18	60	15	31	36	38	39	31	60	0.30	— 1.2	1	5,998	nw.	38	nw.	22	22	6	3	2.8	T.
Amarillo	3,676	54	61	26.29	30.16	+ .03	39.2	+ 2.9	70	17	52	1	31	26	40	29	15	47	0.07	— 0.7	2	10,197	nw.	40	n.	2	22	6	3	2.3	0.8
Southern Plateau.							44.2	+ 1.6										39	0.04	— 1.4									1.6	
El Paso	3,762	10	110	26.26	30.19	+ .08	44.6	— 1.5	72	21	61	21	25	28	42	32	14	37	T.	— 0.5	0	5,755	nw.	41	w.	21	24	7	0	1.5	T.
Santa Fe	7,013	47	50	23.27	30.21	+ .09	32.4	+ 1.6	52	14	42	7	31	22	27	23	10	47	0.08	— 0.8	3	4,633	nw.	27	ne.	27	26	5	0	1.5	0.5
Flagstaff	6,907	12	25	23.38	30.28	.....	33.1	+ 2.6	57	16	48	— 7	31	19	41	28	...	....	0.04	— 3.4	1	.....	e.	....	.....	...	19	8	4	....	0.8
Phoenix	1,108	47	57	28.92	30.11	+ .02	53.7	+ 1.1	79	9	68	22	31	39	37	41	27	42	0.00	— 1.1	0	2,575	e.	13	e.	7	24	7	0	1.3	
Yuma	141	16	50	29.91	30.06	+ .03	58.0	+ 2.0	80	7	72	31	30	44	37	44	24	29	0.00	— 0.5	0	5,492	n.	34	n.	28	26	3	2	1.0	
Independence	3,910	51	58	26.12	30.16	+ .06	43.4	+ 4.1	66	5	55	15	31	32	36	34	19	40	0.13	— 1.9	3	5,467	nw.	48	sw.	21	18	13	0	2.5	
Middle Plateau.							33.8	+ 2.4										63	0.19	— 1.2									4.4	
Carson City	4,720	82	92	25.40	30.28	+ .15	35.8	+ 1.1	57	4	48	6	31	23	34	31	26	71	0.48	— 1.7	5	3,938	nw.	59	sw.	16	12	10	9	4.5	2.0
Winnemucca	4,344	59	70	25.82	30.31	+ .12	33.0	+ 1.9	57	20	44	4	31	22	32	30	25	73	0.12	— 1.2	3	6,188	sw.	58	sw.	14	12	6	13	5.4	T.
Cedar City *	5,850	36	47	24.42	30.34	+ .19	37.3	.....	57	20	48	12	12	26	33	30	20	60	0.00	.....	0	1,900	se.	20	s.	15	10	8	2	3.8	
Salt Lake City	4,366	105	110	25.78	30.32	+ .10	35.0	+ 2.2	56	21	42	2	31	28	23	30	23	63	0.16	— 1.5	1	3,335	se.	48	n.	21	10	9	12	5.5	2.0
Grand Junction	4,608	43	50	25.52	30.34	+ .15	31.2	+ 4.4	54	8	45	3	31	18	33	23	11	47	T.	— 0.4	0	2,767	se.	20	sw.	21	20	7	4	3.0	T.
Northern Plateau.							35.9	+ 4.6										33	1.22	— 0.8									7.6	
Baker City	3,471	53	58	26.58	30.27	+ .10	32.8	+ 4.3	54	20	38	2	31	28	18	30	26	79	0.85	— 0.9	13	4,127	s.	50	sw.	21	2	5	24	8.4	4.2
Boise	2,739	61	68	27.36	30.30	+ .07	36.4	+ 3.2	57	14	44	11	31	29	21	33	29	78	0.47	— 1.5	9	3,159	se.	25	e.	16	4	10	17	7.0	1.1
Lewiston	770	52	61	.....	.....	.....	41.7	.....	57	7	47	18	31	36	19	....	....	....	0.93	.....	10	3,611	e.	29	w.	21	8	9	14	6.6	0.8
Pocatello	4,482	48	56	25.64	30.32	+ .10	31.2	+ 5.2	49	16	38	—15	31	24	27	28	24	78	0.95	— 0.6	7	8,650	s.	42	w.	21	4	9	18	7.4	4.5
Spokane	1,943	99	107	28.07	30.18	+ .06	37.1	+ 5.8	53	5	41	13	31	33	14	36	33	87	2.87	+ 0.3	15	4,130	sw.	30	sw.	16	0	4	27	9.1	T.
Walla Walla	1,000	65	73	29.07	30.17	+ .06	42.0	+ 4.3	64	5	48	18	31	36	24	41	39	91	0.97	— 1.2	16	4,632	s.	35	s.	20	3	13	15	6.8	T.
N. Pac. Coast Reg.							44.8	+ 3.0										87	10.41	+ 1.5									7.7	
Neah Bay	50	7	52	29.94	30.00	+ .06	45.2	+ 2.2	55	20	48	29	30	42	11	45	43	92	21.81	+ 5.5	25	6,153	e.	40	w.	21	2	6	23	8.2	T.
Port Crescent	259	14	20	.....	.....	.....	42.6	+ 3.2	55	18	47	26	31	38	17	....	....	....	9.54	+ 2.6	19	2,283	sw.	36	sw.	16	1	5	25	8.7	
Seattle	123	114	121	29.94	30.07	+ .04	45.8	+ 4.0	62	5	50	27	31	42	14	44	41	85	7.21	+ 1.7	19	4,736	se.	30	se.	20	3	6	22	8.2	
Tacoma	213	113	120	.....	.....	.....	44.2	+ 3.3	61	5	48	23	31	40	14	....	....	....	7.97	+ 0.6	21	4,585	s.	38	s.	20	2	3	26	8.8	
Astoria	20	57	64	.....	.....	.....	45.8	+ 1.8	58	19	50	30	31	41	17	....	....	....	16.25	+ 4.0	21	.....	ne.	48	s.	19	9	4	18	6.8	
Portland, Oreg	154	208	213	29.94	30.11	+ .03	44.8	+ 3.5	60	20	50	25	30	39	16	43	41	86	6.01	— 1.8	19	6,171	se.	48	s.	16	2	7	22	7.7	
Roseburg	518	56	67	29.54	30.12	+ .01	45.1	+ 3.1	66	18	51	26	31	39	26	43	40	85	4.09	— 2.4	13	2,619	s.	36	s.	15	10	10	11	5.3	
Mid. Pac. C'st Reg.							49.0	+ 0.4										80	2.40	— 3.2									5.7	
Eureka	62	60	69	30.09	30.15	+ .08	50.8	+ 3.0	65	18	56	34	31	46	18	49	46	82	5.27	— 2.9	9	4,747	se.	36	sw.	20	10	12	9	5.3	
Mount Tamalpais	2,375	11	18	27.67	30.17	.....	48.8	.....	66	7	54	33	31	44	17	42	34	66	2.82	.....	9	15,131	nw.	55	nw.	21	14	9	8	4.3	
Red Bluff	332	50	56	29.83	30.20	+ .08	45.4	— 1.3	67	1	51	29	31	40	25	43	40	85	2.07	— 3.2	9	3,276	se.	35	se.	20	9	6	16	6.3	
Sacramento	69	106	117	30.13	30.21	+ .10	45.2	— 1.9	60	21	50	30	31	40	21	44	42	86	1.38	— 2.8	8	4,697	se.	40	s.	14	5	7	19	7.5	
San Francisco	155	161	167	30.03	30.19	+ .09	50.2	— 1.2	63	27	55	40	31	45	21	48	45	82	1.37	— 3.7	6	5,453	n.	48	s.	14	11	11	9	5.0	
Point Reyes Light	.....	12	16	.....	.....	.....	53.4	+ 3.5	73	6	60	40	27	47	25	....	....	....	1.93	— 3.4	5	6,609	se.	54	nw.	29	9	13	9	5.6	
S. Pac. Coast Reg.							55.4	+ 2.7										66	0.15	— 2.9									3.8	
Fresno	330	67	70	29.83	30.19	+ .07	45.2	— 1.1	61	18	51	26	31	40	21	43	41	87	0.33	— 1.2	3	2,659	nw.	20	w.	14	1	4	26	8.4	
Los Angeles	338	74	82	29.71	30.07	+ .02	60.4	+ 5.0	85	6	73	37	30	48	34	49	40	55	T.	— 4.0	0	2,729	ne.	14	nw.	30	21	9	1	2.1	
San Diego	87	94	102	29.94	30.04	— .01	60.4	+ 4.6	79	7	68	44	29	52	25	51	42	58	0.00	— 2.1	0	3,660	nw.	22	ne.	28	29	1	1	1.4	
San Luis Obispo	201	10	46	29.93	30.15	+ .09	55.6	+ 2.2	84	6	68	31	29	44	41	47	40	63	0.26	— 4.2	1	3,761	n.	27	n.	1	20	7	4	3.1	
West Indies.																														
Basseterre	29	41	54	29.99	30.02	.....	78.5	.....	86	3	84	70	22	74	15	73	70	75	3.17	.....	25	7,014	e.	25	e.	11	12	15	4	4.6	
Bridgetown	30	57	65	29.94	29.97	.....	79.6	.....	87	5	86	71	18	74	15	73	71	75	2.56	— 0.5	16	6,520	e.	24	ne.	14	7	23	1	5.1	
Cienfuegos †	52	62	67	29.98	30.03	.....	75.0	.....	87	2	83	61	31	67	23	69	68	86	0.87	.....	6	4,446	ne.	19	ne.	9	14	8	5	4.0	
Grand Turk	11	6	20	.....	.....	.....	77.8	.....	87	15	83	68	18	73	17	....	....	....	3.04	.....	10	.....	ne.	....	.....	...	1	20	10	6.3	
Havana	57	87	105	29.99	30.05	.....	74.2	.....	86	31	80	63	22	68	18	68	66	83	1.78	— 0.4	10	8,119	e.	31	e.	27	5	14	12	6.0	
Kingston	286	38	52	29.68	29.98	.....	77.8	.....	90	15	87	65	31	69	22	70	67	77	1.64	.....	7	3,978	ne.	19	se.	28	6	22	3	4.7	
Port of Spain	40	65	66	29.91	29.95	.....	79.0	.....	89	3	86	69	26	72	17	72	70	78	2.44	.....	15	3,043	e.	16	e.	9	5	18	8	6.1	
Puerto Principe	352	55	62	29.69	30.04	.....	74.8	.....	89	14	84	61	19	66	25	69	69	92	3.49	.....	8	4,773	ne.	24	e.	23	15	9	7	4.6	
Roseau	25	37	47	29.96	29.98	.....	78.9	.....	89	6	86	70	30	72	16	72	69	75	2.13	.....	17	3,674	ne.	16	e.	14	15	15	1	3.7	
San Juan	82	48	90	29.95	30.03	.....	77.3	.....	87	9	83	68	26	72	14	73	71	82	2.39	— 1.9	17	6,783	e.	32	e.	25	18	10	3	3.4	
Santiago de Cuba	82	26	31	29.91	29.99	.....	78.4	.....	90	15	87	65	31	70	23	71	69	80	0.34	.....	3	2,657	ne.	17	ne.	18	14	15	2	4.0	
Santo Domingo	57	37	44	29.97	30.03	.....	76.8	.....	87	8	85	63	30	69	22	72	70	87	3.33	.....	11	3,858	n.	14	ne.	6	17	10	4	3.4	
Willemstad	75	39	46	29.85	29.92	.....	80.4	.....	87	2	85	71	17	76	10	74	71	76	1.00	.....	13	8,543	e.	26	e.	30	6	24	1	5.1	

NOTE.—The data at stations having no departures are not used in computing the district averages. * Record for 20 days; station closed December 20, 1900, and moved to Modena, Utah. † Record for 28 days only.

TABLE II.—*Climatological record of voluntary and other cooperating observers, December, 1900.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Ashville	59	24	42.6	3.41	
Benton	.....	.....	.....	4.64	
Bermuda	73	26	50.0	8.36	
Birmingham	64	30	49.1	4.01	
Brewton	73	28	51.8	6.07	
Bridgeport	.....	.....	.....	3.21	
Burkville	.....	.....	.....	6.00	
Calera	.....	.....	.....	4.31	
Citronelle	71	32	53.2	5.43	
Clanton	63	28	45.7	3.44	
Daphne	75*	31[f]	55.0*	4.41	
Decatur	63	22	44.6	2.66	
Demopolis	.....	.....	.....	4.20	
Elba *	76	26	48.4	.....	
Eufaula *a*	74	27	49.0	8.21	
Eufaula *c*	.....	.....	.....	7.69	
Eutaw	67	29	47.9	3.95	
Evergreen	70	29	49.5	5.16	
Florence *a*	.....	.....	.....	2.85	
Florence *b*	64	26	44.2	2.92	
Gadsden	67	20	46.8	4.18	
Goodwater	67	26	45.3	7.38	
Greensboro	68	29	48.5	5.27	
Greenville	.....	.....	.....	4.97	
Hamilton	66	22	43.7	2 81	
Healing Springs	71	24	47.5	5.44	
Helena	.....	.....	.....	2.50	
Highland Home	72	30	49.0	3.70	
Letohatchee	.....	.....	.....	4.85	
Livingston *a*	66	25	45.9	3.69	
Lock No. 4	62	25	42.7	4.26	
Madison Station	63	25	43.8	2.46	
Maplegrove	64	22	41.8	4.06	
Marion	68	30	50.6	5.22	
Mount Willing *	70	29	49.4	.....	
Newbern	64	28	48.0	4.01	
Newton	66	26	45.6	11.54	
Notasulga	.....	.....	.....	8.01	
Oneonto	61	24	43.4	5.47	
Opelika	67	33	46.8	7.17	
Oxanna	63	26	46.3	3.99	
Pineapple	69	24	48.2	4.10	
Prattville	70	27	48.6	.....	
Pushmataha	70	28	48.6	4.70	
Riverton	63	24	42.2	2.92	
Scottsboro	62	28	42.8	4.85	
Selma	68	.....	.....	4.65	
Talladega	63	24	45.0	4.26	
Tallassee	.....	.....	.....	5.55	
Thomasville	67	.....	.....	4.81	
Tuscaloosa	64	26	44.5	4.05	
Tuskegee	72[b]	29	48.2[c]	5.75	
Union Springs	72	31	47.6	6.45	
Uniontown	66	28	49.2	5.03	
Valleyhead	61	20	41.7	4.20	
Verbena	.....	.....	.....	6.17	
Wetumpka	72	28	49.6	6.42	
Alaska.					
Orca	48	7	29.4	13.09	16.0
Sitka	52	24	37.4	6.59	3.5
Arizona.					
Allaire Ranch	...	...	...	0.10	1.0
Arizona Canal Co. Dam	75	26	54.2	0.00	
Aztec *[5]	79	30	55.2	0.00	
Benson *[1]	72	28	49.7	0.00	
Bisbee	70	22	47.0	0.28	1.5
Bowie *[5]	66	28	47.6	0.00	
Buckeye	80	20	51.4	0.00	
Camp Creek	71	22	52.2	0.00	
Casagrande *[1]	78	37	58.2	0.00	
Champie Camp	91[b]	18[b]	54.4[b]	0.00	
Cochise *[1]	70	27	48.2	T.	T.
Congress	74	28	56.0	0.00	
Dragoon Summit	.....	.....	.....	0.10	1.0
Dudleyville	78	18	47.6	T.	
Fort Apache	68	11	39.0	T.	T.
Fort Defiance	55	1	30.4	T.	T.
Fort Grant	79	10	51.6	T.	T.
Fort Huachuca	79	19	49.8	0.15	
Fort Mohave	77	30	53.1	0.00	
Gilabend *[1]	90	38	56.7	0.00	
Ingleside	86	21	53.1	0.00	
Jerome	64	20	46.3	0.00	
Maricopa *[1]	70	30	46.4	0 00	
Mesa	78	18	52.4	0.00	
Mohawk Summit	81	42	62.9	0.00	
Mount Huachuca	71	24	47.0	0.15	1.5
Natural Bridge	.....	.....	.....	0.00	
Nogales	73	24	47.4	0.00	
Oracle	65	26	48.8	T.	T.
Oro	.....	.....	.....	0.00	
Pantano *[1]	75	38	51.2	0.30	
Parker	85	21	53.1	0.00	
Peoria	80	19	53.5	0.00	
Phoenix	77	18	51.6	0.00	
Pima	69	15	43.6	0.00	
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pinal Ranch	.....	.....	.....	0.00	
Prescott	69	2	38.2	0.00	
Russellville	.....	.....	.....	0.00	
San Carlos	77	18	45.6	0.00	
Sentinel *[1]	80	35	58.4	0.00	
Showlow	.....	.....	.....	0.30	3.0
Signal	84	10	50.6	0.00	
Silverking	.....	.....	.....	0.00	
Strawberry	62	4	37.4	0.00	
Supai	65[b]	16	42.8*	T.	
Tombstone	68	25	48.4	0.09	T.
Tonto	70	21	46.3	0.00	
Tuba	60	11	35.4	0.00	
Tucson	78	28	52.4	T.	
Vail *[1]	74	31	51.0	0.60	
Walnut Grove	.....	.....	.....	0.00	
Willcox *[1]	69	20	41.4	0.00	
Winslow	62	5	33.6	T.	T.
Yarnell	.....	.....	.....	0.00	
Arkansas.					
Amity	71	25	45.0	2.81	
Arkadelphia	71	23	46.7	2.48	
Arkansas City	.....	.....	.....	1.76	
Batesville	71	22	44.7	3.15	
Beebranch	82	25	48.6	2.70	
Blanchard Springs	72	22	47.2	1.78	
Brinkley	68	26	46.0	2.37	
Camden *a*	.....	.....	.....	2.76	
Camden *b*	77	22	45.6	2.80	
Conway	71	21	46.4	3.60	
Corning	68	18	40.4	2.78	
Dardanelle	.....	.....	.....	2.69	
Elon	72[c]	24[c]	46 2[c]	2.53	
Fayetteville	64	15	42.0	1.23	T.
Fulton	.....	.....	.....	2.26	
Hardy	63	20	41.4	1.98	
Helena *a*	.....	.....	.....	5.49	
Helena *b*	68	29	47.0	4.34	
Hot Springs *b*	.....	.....	.....	4.18	
Ione	.....	22	.....	3 50	
Jonesboro	63	24	44.6	2.60	
Keesees Ferry	70	16	43.2	1.54	0.1
Lacrosse	66	20	43.2	1.97	
Lonoke	72	25	45.6	3.37	
Lutherville	68	23	43.4	1.79	
Malvern	63	24	42.0	3.26	
Marianna	67	26	44.3	3.22	
Marvell	68	27	45.7	3.22	
Mossville	60	10	40.0	3.66	T.
Mount Nebo	69	14	42.6	3.41	
New Gascony	70	27	46.2	3.69	
Newport *a*	.....	.....	.....	3.24	
Newport *b*	71	23	44.2	2.89	
Newport *c*	69	21	43.2	3.40	
Oregon	69	18	44.2	1.64	T.
Osceola	69	25	44.3	2.65	
Ozark	66	21	44.7	2.08	T.
Pinebluff	73	25	46.4	4.50	
Pocahontas	61	20	41.6	2.53	
Pond	62	14	40.4	0.72	T.
Prescott	73	25	45.6	2.61	
Rison	74	23	48.0	3.28	
Rosadale	72	24	47.7	1.78	
Russellville	68	26	44.6	2.23	
Silversprings	67	15	41.8	1.14	T.
Spielerville	71	25	45.3	2.10	
Stuttgart	70	25	44.8	3.02	
Texarkana	79	27	51.3	1.27	
Warren	73	24	48.8	3.59	
Washington	72	27	47.6	2.73	
Wiggs	68	22	44.9	3.40	
Winslow	60	13	40.7	0.87	
Witts Springs	63	20	42.4	2.10	
California.					
Angiola	62	20	43.2	0.00	
Bakersfield	67	22	45.0	T.	
Ballast Point L. H	.....	.....	.....	0.00	
Bear Valley	.....	.....	.....	5.90	40.0
Bellevue	.....	.....	.....	1.62	
Berkeley	61	34	49.7	1.83	
Beverly	.....	.....	.....	3.00	30.0
Bishop	.....	.....	.....	0.17	
Boca *[5]	50	0	29.4	4.58	37.0
Bodie	45	−25	21.0	0.64	6.5
Bowman	.....	.....	.....	8.15	26.0
Caliente *[1]	69	35	49.4	0.00	
Campbell	70	26	49.6	1.26	
Cape Mendocino L. H	.....	.....	.....	5.55	
Cedarville	54	7	33.3	0.59	2.0
Chico *[1]	69	28	47.9	1.77	
Cisco *[1]	48	11	36.0	7.50	46.0
Claremont	76	23	52.5	T.	
Corning *[1]	68	32	46.2	2.25	
Coronado	83	41	60.0	.....	
Craftonville	84	25	56.0	0.00	
Crescent City	63	27	49.5	8.12	
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Crescent City L. H	.....	.....	.....	7.65	
Cuyamaca *[5]	57	18	40.4	0.04	
Delano *[1]	70	29	47.5	0.14	
Delta *[1]	76	37	50.8	8.04	
Deweyville	66	20	44.0	T.	
Drytown	65	26	45.1	2.00	
Dunnigan *[1]	62	28	46.5	2.05	
Durham *[1]	60	22	45.0	1.86	
Edmanton *[1]	59	12	37.2	7.70	22.0
East Brother L. H	.....	.....	.....	1.60	
Elcajon	88	30	55.8	0.00	
Elmdale	62	24	44.0	1.15	
Elsinore	84	24	55.8	0.00	
Escondido	78	15	48.7	0.00	
Fallbrook	82	27	56.2	0.00	
Folsom City *[1]	66	28	47.0	1.67	
Fordyce Dam	.....	.....	.....	3.98	16.0
Fort Ross	70	35	51.8	6.33	
Fort Tejon	.....	.....	.....	0.50	
Georgetown	72	23	48.3	4.16	
Gilroy (near)	74	24	50.0	0.92	
Goshen *[5]	60	27	44.5	0.15	
Grand Island *[5]	63	30	47.0	1.03	
Grass Valley	.....	.....	.....	4.15	
Greenville	60	8	37.4	4.73	5.0
Hanford	60	20	42.8	.....	
Healdsburg	70	25	47.0	5.23	
Hollister	69	21	48.0	0.97	
Humboldt L. H	.....	.....	.....	4.62	
Indio *[1]	82	32	52.5	0.00	
Iowa Hill *[1]	68	27	48.0	3.16	
Irvine	90	38	63.2	0.00	
Jackson (near)	66	20	43.7	2.24	
Jolon	.....	.....	.....	0.53	
Kennedy Gold Mine	62	23	42.4	2.53	
Kent	.....	.....	.....	4.48	
Kernville	.....	.....	.....	0.00	
Kingsburg *[1]	62	29	48.4	0.34	
Kono Tayee	59	29	46.4	1.67	
Lamesa	.....	.....	.....	0.00	
Lankershim	69	28	46.0	0.40	
Laporte *[1]	59	9	36.8	8.79	28.2
Las Fuentes Ranch	.....	.....	.....	0.00	
Legrand	60	24	43.8	0.51	
Lemoncove	67	28	47.8	0.50	
Lemoore *[1]	61	22	41.4	0.29	
Lick Observatory	72	23	47.2	2.21	
Lime Point L. H	.....	.....	.....	1.34	
Lodi	61	24	46.4	1.06	
Los Gatos *b*	69	32	50.9	2.50	
Mammoth *[1]	80	32	57.3	0.00	
Manzana	70	24	51.0	0.00	
Mare Island L. H	.....	.....	.....	1.35	
Merced *b*	63	25	43.8	0.57	
Mills College	.....	.....	.....	1.79	
Milo	...	...	...	0.26	
Milton (near)	.....	.....	.....	0.97	
Modesto *[1]	69	35	50.1	0.92	
Mohave *[1]	65	25	47.8	0.00	
Mokelumne Hill *[5]	.....	30	42.6	1.76	
Monterio	72	24	53.9	0.00	
Monterey *[1]	76	28	53.4	1.10	
Morena	71	25	50.1	0.00	
Mountainview	.....	.....	.....	1.27	
Mutah	.....	.....	.....	0.00	
Napa *b*	63	30	48.4	2.21	
Needles	75	30	53.2	0.00	
Nevada City	66	18	43.9	4.00	
North Bloomfield	73	19	46.9	4.95	1.0
North Ontario	75	32	55.8	0.00	
North San Juan *[1]	78	21	47.4	5.07	
Oakland *a*	65	33	50.0	1.58	
Ogilby *[1]	82	35	60.8	0.00	
Oleta *[1]	66	20	43.0	1.61	
Orland *[1]	60	29	45.0	1.68	
Palermo	62	33	45.0	2.15	
Paso Robles *b*	71	18	45.6	0.25	
Peachland *[5]	63	29	49.3	5.10	
Piedras Blancas L. H	.....	.....	.....	0.39	
Pigeon Point L. H	.....	.....	.....	1.46	
Pilot Creek	.....	.....	.....	4.41	5.0
Pine Crest	82	38	62.3	T.	
Placerville	68	18	44.4	3.30	
Point Ano Nuevo L. H	.....	.....	.....	1.40	
Point Arena L. H	.....	.....	.....	4.13	
Point Bonita L. H	.....	.....	.....	2.35	
Point Conception L. H	.....	.....	.....	0.10	
Point Firmin L. H	.....	.....	.....	0.00	
Point George L. H	.....	.....	.....	4.33	
Point Hueneme L. H	.....	.....	.....	0.02	
Point Lobos	59	40	49.7	1.37	
Point Loma L. H	.....	.....	.....	0.00	
Point Montara L. H	.....	.....	.....	2.92	
Point Pinos L. H	.....	.....	.....	1.44	
Point Sur L. H	.....	.....	.....	0.49	
Pomona (near)	80	27	54.8	0.00	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Poway *5	87	26	56.9	0.00	
Quincy	55	12	36.0	4.70	1.5
Ranch House				0.00	
Redding	68	30	46.8	3.14	
Redlands	79	28	55.9	0.00	
Reedly	63	26	45.1	0.00	
Represa	62	28	46.4	1.63	
Riovista	60	28	45.4	1.35	
Riverside	83	35	59.4	0.00	
Roe Island L. H				1.27	
Rosewood	72	19	44.8	2.77	
Sacramento *a*	59	26	45.7	1.48	
Salinas *1	79	27	66.2	0.71	
Salton *1	81	35	53.4	0.00	
San Bernardino	83	23	55.1	0.00	
San Jacinto	79	26	52.0	0.00	
San Leandro *5	64	28	49.2	1.91	
San Luis L. H				0.15	
San Mateo *1	67	33	48.6	2.31	
San Miguel *1	71	20	47.6	0.12	
San Miguel Island	84	43	58.4	0.17	
Santa Ana	83	38	59.8	0.00	
Santa Barbara *a*	84	38	59.8	0.02	
Santa Barbara L. H				0.02	
Santa Clara *a*				1.38	
Santa Cruz *b*	77	25	50.2	2.48	
Santa Cruz L. H				2.13	
Santa Maria	82	32	56.3	0.35	
Santa Monica				0.00	
Santa Paula	83	38	61.2	T.	
Santa Rosa *1	64	26	51.0	3.35	
Shasta	77	28	48.6	7.45	
Sierra Madre	79	35	58.8	0.00	
Snedden				0.00	
Sonoma				2.52	
S. E. Farallone L. H				1.83	
Stockton	55	23	42.8	1.08	
Summerdale	68	13	43.6	1.79	3.0
Susanville	52	6	30.4	2.00	2.0
Tehama *1	63	34	48.1	2.02	
Tejon Ranch	75	24	48.0	0.34	
Templeton *1	72	26	42.2	0.30	
Thermalito	61	28	45.4	2.10	
Trinidad L. H				4.60	
Truckee *1	48	7	32.1	2.70	27.0
Tulare *b*				0.26	
Tulare *c*	64	26	45.6	0.19	
Ukiah	86	21	47.4	4.98	
Upperlake	74	29	48.0	3.63	
Upper Mattole				13.31	
Vacaville *1	62	32	47.0	1.68	
Ventura	88	37	60.2	0.03	
Visalia *b*	64	22	44.8	0.23	
Volcano Springs *1	86	34	56.3	0.00	
Walnutcreek	68	28	49.8	1.73	
Westpoint				2.46	
West Saticoy				0.00	
Wheatland	59	25	44.2	1.66	
Williams *1	65	34	50.1	0.77	
Wilmington *1	78	40	54.3	0.00	
Wire Bridge *5	63	22	45.8	1.95	
Yerba Buena L. H				1.40	
Yreka	56	16	38.6	3.23	
Yuba City *5	64	27	47.7	1.71	
Colorado.					
Alford	65	—23	33.4	0.12	2.0
Arkins				0.22	3.0
Blaine	78	—17	36.8	0.33	5.0
Boulder	65	—11	38.9	0.61	9.2
Boxelder				0.21	3.0
Breckenridge	46	—22	12.6	0.70	10.5
Buenavista				0.01	0.2
Canyon	67	—25	37.4	0.40	7.5
Castlerock	61	—29	31.5	0.30	5.0
Cedaredge	54	— 2	31.1	T.	T.
Cheyenne Wells	66	—16	32.4	0.18	2.0
Clearview	50	—21	25.2	1.08	14.5
Collbran	51	— 2	27.7	0.22	3.2
Colorado Springs	60	—16	33.2	0.08	0.5
Cope	64	—18	33.6	0.45	5.5
Crook	65	—19	31.6	0.15	3.0
Delta	54	— 3	29.6	T.	T.
Dumont				0.52	8.0
Durango	56	—11	26.0	T.	T.
Fort Collins	63	—22	31.7	0.11	1.8
Fort Morgan	62	—21	30.0	0.11	1.5
Fox				0.62	7.0
Gleneyrie	58	—11	32.8	0.18	2.2
Greeley	65	—21	31.0	0.16	2.0
Grover				T.	T.
Hamps	63	—20	31.2	1.03	12.5
Hoehne	68	—29	32.8	0.47	6.0
Holly	68	—14	34.6	0.20	2.5
Holyoke	70	—10	31.8	0.03	0.5
Hugo				0.37	5.0
Husted	60	—24	29.7	0.18	2.2
Lake Moraine	46	—14	22.4	0.39	7.0
Lamar	72	—15	35.0	0.37	4.0
Laporte				0.23	3.0
Las Animas	75	—19	34.4	0.40	5.0
Lay	50	—25	23.8	0.20	3.0
Leadville (near) *1	42	—14	17.0	0.88	14.5
Leroy	67	—18	33.6	0.20	3.0
Longs Peak	50	—27	26.2	0.64	9.0
Mancos	56	— 9	29.7	0.06	1.0
Marshall Pass				0.70	12.0
Mitchell				0.26	5.5
Montrose				0.05	0.5
Moraine	51	—25	28.0	0.48	7.0
Pagoda	54	—24	26.0	0.71	9.6
Parachute	50	0	29.8	0.02	0.5
Perrypark				0.44	
Rangely	48	— 9	23.8	T	T.
Rockyford	70	—21	32.5	0.24	3.0
Rogers Mesa	53	2	30.2	T.	T.
Ruby				1.17	18.0
Saguache	60	—17	25.2	T.	T.
Salida	70	—21	30.2	0.12	1.8
San Luis	55	—10	25.2	0.05	0.5
Santa Clara	58	—18	30.8	1.30	17.0
Sapinero				0.07	1.5
Sargents				0.41	7.0
Selbert				0.43	5.0
Silt	52	— 4	29.5	0.02	
Springfield				0.10	2.0
Sugarloaf	52	—20	29.6	0.97	13.0
Telluride	48	—13	24.0	0.09	1.5
Trinidad	68	—19	36.6	0.40	8.0
Troutvale	43	—30	11.5	0.05	1.0
T. S. Ranch	52	— 1	30.8	T.	T.
Twinlakes				0.09	1.5
Vilas				T.	T.
Wagon Wheel	49	—28	13.0	0.05	1.0
Walden	45	—32	17.8	0.33	5.2
Wallet				0.17	2.0
Westcliffe	54	—19	28.1	0.31	5.0
Wray	70	—16	33.4	0.34	4.0
Yuma				0.51	6.0
Connecticut.					
Bridgeport	59	7	32.2	2.70	0.8
Canton	59	— 2	29.2	2.60	2.0
Colchester	59	3	31.3	2.17	2.0
Falls Village				2.71	4.5
Hartford *b*	57	6	31.2	2.83	1.5
Hawleyville	57	4	30.6	2.87	2.0
Lake Konomoc				3.00	
Middletown	61	2	31.2	2.78	1.8
New London	49	8	31.7	1.86	T.
North Grosvenor Dale	57	1	28.8	2.46	T.
Norwalk	57	2	30.2	2.54	0.3
Southington	55	1	30.8	2.45	2.0
Storrs	56	3	28.8	2.22	2.0
Voluntown	57	0	30.6	2.71	1.0
Waterbury	57	3	31.4	2.56	1.5
West Cornwall	56	0	27.6	3.00	7.8
West Simsbury				2.29	2.0
Winsted *1	54	2	27.7		
Delaware.					
Milford				2.67	9.0
Millsboro	65	11	34.6	3.65	6.0
Newark	56	12	33.0	2.63	0.5
Seaford	63	16	36.6	2.50	4.0
Wyoming				2.92	5.5
District of Columbia.					
Distributing Reservoir *5	58	16	36.8	2.41	
Receiving Reservoir *5	55	13	35.0	2.47	
West Washington	64	14	35.3	2.45	T.
Florida.					
Archer	79	32	56.2	5.70	
Bartow	83	34	61.0	6.35	
Brooksville	78	37	59.4	4.76	
Carrabelle	70	35	54.8	8.27	
Clermont	83	41	59.2	5.15	
Dalkeith	79	31	54.4	5.07	
De Funiak Springs	73	30	52.3	7.21	
Deland	83	28	58.8		
Earnestville	82	40	60.1	7.80	
Eustis	83	38	61.2	2.88	
Federal Point	80	35	57.4	5.54	
Fort George *1	78	42	58.4		
Fort Meade	83	33	61.0	5.85	
Gainesville	85	36	57.4	4.34	
Huntington	82	35	56.8	4.54	
Hypoluxo	84	53	71.6	1.73	
Inverness	81	31	57.6	3.61	
Kissimmee	84	37	61.9	5.09	
Lake Butler	89	30	56.6	5.04	
Lake City	79	31	55.4	3.96	
McAlpin	78	31	56 7	2.08	
Macclenny	82	28	54.8	4.23	
Manatee	80	35	60.6	4.41	
Marco	84	50	68.1	1.75	
Florida—Cont'd.					
Marianna	76	33	52.0	4.21	
Merritt Island	83	47	68.6	4.67	
Miami	89	52	71.2		
Middleburg	79	27	53.6	6.38	
Myers	80	46	64.4	2.78	
New Smyrna	82	34	60.2	2.16	
Ocala	82	32	58.0	5.97	
Orange City	82	32	59.2	2.36	
Orlando	81	40	60.7	3.36	
Plant City	84	33	59.8	3.87	
Rockwell	76	31	57.0	6.33	
St. Andrews	70	33	53.1	5.06	
St. Augustine	71	42	54.5	3.83	
St. Francis	82	26	57.0	2.36	
Sebastian	81	47	64.2	3.99	
Stephensville *1	85	35	50.4	5.19	
Sumner	76	26	55.4	6.45	
Switzerland *1	77	34	54.8	5.12	
Tallahassee	71	35	52.8	4.63	
Wausau	69	35	52.0		
Georgia.					
Adairsville	63	27	42.4	4.38	
Albany				7.00	
Allapaha	74	29	48.6	4.10	
Allentown	67	28	48.3	8.06	
Americus	67	30	47.0	10.11	
Athens *b*	60	28	43.0	5.68	
Auburn	67	26	45.0	5.82	
Blakely	72	30	49.8	5.85	
Brent	69	28	46.7	6.02	
Canton				3.92	
Carlton				4.09	
Clayton	57	20	41.0	5.98	
Columbus	65	33	46.0	7.55	
Covington	71	26	46.0	7.66	
Dahlonega	63	19	39.7	5.47	
Diamond	60	22	41.0	5.42	T
Dublin				8.34	
Elberton	67	30	46.2	5.32	
Experiment	69	29	46.0	5.93	
Fitzgerald	76	26	50.8	4.32	
Fleming	78	27	49.6	4.26	
Fort Gaines	72	31	48.8	10.90	
Franklin	67	30	46.5	6.95	
Gainesville	64	25	44.2		
Gillsville	67	22	43.2	3.20	
Greenbush	64	22	42.3	4.63	
Harrison	64	27	47.4	7.03	
Hawkinsville	67	32	48.0	7.37	
Hephzibah				6.20	
Jesup	77	29	51.4	3.96	
Lost Mountain	68	27	44.8	4.88	
Lumpkin	69	33	49.6	8.27	
Marshallville	68	33	49.2	8.66	
Mauzy	78	26	52.0	4.52	
Millen	71	23	47.2	7.39	
Monticello				5.48	
Morgan	71	27	49.0	4.85	
Naylor	76	26	52.0	3.69	
Newnan	66	29	43.2	6.72	
Oakdale				5.84	
Piscola	73	33	53.2	2.90	
Point Peter	68	25	45.0	5.69	
Poulan	77	26	49.6	4.42	
Putnam				8.33	
Quitman	77	26	51.4	3.66	
Ramsey	62	22	43.8	5.05	
Resaca				5.24	
Rome	64	25	42.7	4.63	
Statesboro		28		8.38	
Talbotton	73	29	47.4	5.93	
Tallapoosa	64	26	44.4	4.97	
Thomasville	73	31	51.9	3.73	
Toccoa				4.75	
Valona	75	32	51.5	3.86	
Washington				5.58	
Waycross	76	32	52.2	2.76	
Waynesboro	66	23	44.0	5.28	
Westpoint	63	31	47.8	5.86	
Woodbury				6.97	
Idaho.					
Albion	55	3	32.4	1.28	5.8
American Falls	48	—19	27.6	0.72	
Atlanta	46	—12	25.2	2.23	22.5
Blackfoot	47	—25	26.1	0.80	6.0
Burnside	49	—10	25.4	0 25	2.0
Chesterfield	41	—20	21.8	0.50	2.0
Downey	44	—12	27.5	0.10	
Forney	47	—16	24.7	0.76	2.3
Garnet	55	14	36.4	0.22	T.
Hagerman	57	10	36.0	0.46	T.
Hailey				1.08	12.1
Kootenai	44	16	33.0	2.28	7.0
Lake	44	—10	24.2	1.30	13.0
Lakeview	52	9	36.3	4.84	1.5
Lost River	40	—16	19.4	0.28	0.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Moscow	52	7	34.7	5.53	2.0
Murray	48	— 5	32.1	4.47	13.0
Oakley	56	2	34.4	0.15	T.
Ola	52	9	35.1	1.93	1.4
Paris	45	— 5	22.8	0.64	.....
Payette	58	10	35.6	0.75	0.5
Pollock	58	16	38.6	1 74	1.0
Priest River	51	5	34.8	3.33	5.5
St. Maries	51	8	36.2	3.92	5.0
Soldier	44	—15	22.1	1.64	8.0
Swan Valley	44	—34	23.8	0.84	8.0
Weston	49	— 2	31.0	0.23	T.
Illinois.					
Albion	60	15	36.0	1.79	.....
Aledo	56	4	30.4	0.35	0.2
Alexander	59	8	33.2	0.24	1.2
Ashton	51	5	28.4	0.40	2.2
Astoria	56	8	31.8	0.34	1.2
Aurora *a*	52	4	28.4	0.41	1.7
Bloomington	57	8	31.2	0.65	2.1
Bushnell	55	8	30.5	0.02	T.
Cambridge	52	0	28.8	0.05	T.
Carlinville	60	10	34.0	0.95	3.5
Carlyle	.....	.....	.....	1.70	.....
Centralia	.....	15	.....	1.55	0.9
Charleston	58	6	32.6	1.23	2.8
Chemung	49	8	26.8	0.95	11.8
Chester	.....	.....	.....	1.65	2.0
Cisne	64	13	35.8	1.64	2.2
Coatsburg	56	5	32.0	0.31	0.2
Cobden	65	16	39.1	2.90	.....
Danville	45	8	28.6	0.11	1.7
Decatur	60	6	32.2	0.92	2.5
Dixon	52	6	28.4	0.34	2.0
Dwight	53	4	29.2	0.42	3.5
Effingham	60	12	34.4	1.67	2.5
Equality	65	17	40.0	2.12	0.0
Flora	61	13	35.8	1.94	0.2
Friendgrove[*5]	62	18	38.6	2.02	1.1
Galva	54	1	28.9	0.16	1.6
Grafton	.....	.....	.....	0.96	1.0
Grayville	60	20	39.1	2.10	1.0
Greenville	66	10	35.2	1.20	2.3
Griggsville	59	8	33.9	0.45	0.6
Halfway	61	18	39.1	1.92	T.
Halliday	64	11	38.4	1.87	.....
Havana	55	8	30.5	0.40	2.0
Henry	55	7	30.3	0.14	1.8
Hillsboro	58	9	33.4	0.95	3.0
Joliet	53	0	29.2	0.53	2.8
Kishwaukee	51	— 3	27.5	0.48	3.2
Knoxville	55	3	28.4	0.45	0.8
Lagrange	53	0	29.7	0.32	2.5
Laharpe	52	6	29 6	0.25	2.0
Lanark	50	2	26.2	0.72	8.5
Loami	.....	.....	.....	0.36	2.0
McLeansboro	62	17	37.5	1.25	0.5
Martinsville	59	14	33.3	0.72	1.5
Martinton	60	7	30.2	0.52	2.5
Mascoutah	60	15	34.6	1.44	2.5
Mattoon	60	14	35.6	2.02	2.8
Minonk	55	5	29.8	0.37	2.0
Monmouth	55	4	27.4	0.25	0.5
Monticello	60	7	32.1	1.01	2.0
Morrisonville	58	9	33.2	1.06	3.0
Mount Carmel	.....	.....	.....	2.09	0.5
Mount Pulaski	57	6	32.5	0.68	2.2
Mount Vernon	60	12	34.2	1.67	1.5
New Burnside	62	16	38.8	1.61	T.
Olney	62	13	35.6	1.67	2.8
Ottawa	55	5	31.4	0.31	1.0
Palestine	60	12	32.8	2.64	3.5
Pana	60	10	33.2	1.21	2.5
Paris	58	14	32.7	0.98	.....
Peoria *a*	.....	.....	.....	0.52	3.0
Peoria *b*	56	7	31.6	0.39	0.6
Philo	58	4	31.1	1.34	3.8
Plumhill	62	12	36.4	1.12	0.6
Rantoul	57	9	31.2	0.93	1.3
Raum	61	19	39.4	2.05	0.0
Riley	53	— 3	27.8	0.42	4.0
Robinson	60	12	33.4	1.74	2.0
Rushville	58	8	31.6	0.39	1.5
St. Charles[*3]	50	0	29.0	0.64	2.9
St. John	66	16	39.4	2.59	.....
Scales Mound	50	3	26.8	0.35	4.0
Shobonier	60	9	33.6	1.01	1.2
Strawn	56	9	30.5	0.71	2.0
Streator	65	11	30.6	0.34	.....
Sullivan	58	5	30.8	1.65	1.2
Sycamore	49	10	29.3	0.53	1.3
Tilden	60	17	35.6	1.19	1.8
Tiskilwa	50	5	29.0	0.22	0.7
Tuscola	59	3	31.4	1.53	4.0
Walnut	52	9	30.3	0.29	0.5
Wheaton[*3]	.....	14	29.2	0.60	.....
Illinois—Cont'd.					
Winchester	59	7	32.6	0.26	1.0
Winnebago	51	— 2	28.0	0.57	6.0
Yorkville	54	3	29.0	0.13	0.5
Zion	51	6	27.6	0.60	6.0
Indiana.					
Anderson	56	10	32.0	1.54	5.6
Angola	51	7	28.6	0.65	2.5
Auburn	55	5	29.6	0.45	1.5
Bedford	.....	15	.....	1.55	T.
Bloomington	71	12	36.6	2.05	5.0
Bluffton	58	— 2	30.0	0.93	3.5
Boonville	73	20	39.4	1.65	.....
Bright	54	15	34.8	1.02	1.0
Butlerville	57	14	34.4	1.95	1.8
Cambridge City	55	9	30.9	0.93	1.6
Columbus	59	14	34.4	1.16	1.2
Connersville	52	13	31.7	0.58	0.7
Delphi	57	9	29.8	0.57	0.5
Edwardsville[*1]	58	20	38.8	2.03	0.1
Fairmount	58	10	30.6	0.76	2.5
Farmland	56	4	33.8	1.48	6.0
Franklin[*1]	58	16	34.2	1.24	1.2
Greencastle	58	13	32.4	1.37	2.2
Greensburg	57	10	34.4	0.48	T
Hammond	55	8	28.3	0.66	6.0
Hector	50	5	31.8	1.48	10.0
Huntington	53	1	30.3	0.96	6.5
Jeffersonville	58	20	37.8	1.94	T.
Knightstown	55	12	32.4	1.53	4.5
Kokomo	58	14	32.1	0.81	2.6
Lafayette	57	6	31.8	0.68	2.0
Laporte	51	10	30.2	1.05	6.0
Logansport	54	11	31.2	0.50	1.0
Madison *a*	59	16	36.6	1.99	T.
Madison *b*	.....	.....	.....	1.88	T.
Marengo	60	15	36.0	1.71	0.0
Marion	56	9	31.0	0.91	4.7
Markle	58	6	30.7	0.60	4.0
Mauzy	56	9	31.4	1.11	2.6
Mount Vernon	63	19	40.4	3.10	T.
Northfield	55	0	30.5	0.80	3.5
Paoli	61	14	36.0	2.29	T.
Peru	52	10	29.8	1.25	5.0
Prairie Creek	60	12	34.8	0.83	1.6
Princeton	62	16	34.5	2.32	1.0
Rensselaer	.....	.....	.....	0.40	.....
Richmond	55	10	31.6	1.06	2.0
Rockport	.....	.....	.....	1.10	0.0
Rockville	58	9	32.0	1.03	3.0
Salem	61	14	36.2	1.67	.....
Scottsburg	58	18	36.1	1.78	T.
Seymour	57	17	34.8	1.95	1.5
Shelbyville	55	9	34.3	1.11	T.
South Bend	51	11	30.1	0.62	3.0
Syracuse	50	9	27.7	0.76	3.5
Terre Haute	61	16	35.0	1.35	1.2
Topeka	56	10	31.6	0.48	T.
Valparaiso	52	12	32.6	0.20	2.0
Veedersburg	57	9	30.0	0.43	2.5
Vevay	60	18	37.9	2.35	0.5
Vincennes	60	16	35.7	1.80	3.5
Washington	60	15	34.8	2.23	0.1
Winamac	54	8	30.8	0.01	0.1
Worthington	60	12	33.8	1.92	4.3
Indian Territory.					
Bengal	71	20	45.1	1.67	
Claremore	65	13	41.9	0.22	
Colbert	74	.....	.....	T.	
Fairland	64	11	40.0	0.40	
Hartshorne	73	17	47.8	1.15	T.
Healdton	72	13	44.8	0.23	
Lehigh	74	18	45.6	0.23	
Marlow	71	12	43.2	0.06	T.
Muscogee	72	14	43.6	1.12	
Pauls Valley[j]	69	23	46.6	0.60	
Ryan	70	15	45.0	T.	
South McAlester	.....	.....	.....	1.33	T.
Tahlequah	66	16	42.6	0.40	T.
Tulsa	.....	.....	.....	0.00	
Wagoner	69	13	43.8	1.15	
Webbers Falls	70	18	46.1	1.46	
Iowa.					
Afton	51	— 5	28.6	0.25	2.0
Albia	62	— 3	29.8	0.60	1.0
Algona[*1]	47	— 9	24.1	0.35	3.5
Alta *a*	52	— 7	24.4	0.55	4.2
Amana	53	— 2	27.8	0.44	0.5
Ames *b*	60	— 3	27.2	0.19	.....
Ames (near)	.....	.....	.....	0.58	2.6
Atlantic	55	— 1	27.8	1.24	9.5
Audubon	55	3	31.2	0.20	2.0
Bancroft	51	— 8	24.2	0.40	3.0
Batavia	.....	.....	.....	0.10	T.
Baxter	55	— 8	26.6	0.97	2.9
Belknap	55	— 1	29.6	1.06	1.0
Belleplaine	56	— 2	25.4	0.55	4.5
Iowa—Cont'd.					
Bonaparte	56	3	30.4	T.	T.
Britt	49	— 7	23.2	0.18	1.0
Buckingham	.....	.....	.....	0.27	2.7
Burlington	57	5	31.2	0.54	2.0
Carroll	56	— 4	27.4	0.30	3.0
Cedar Rapids	54	— 4	27.6	0.92	2.4
Centerville	56	— 2	30.6	0.50	T.
Chariton	55	— 2	29.2	0.48	1.4
Charles City	45	— 4	24.0	0.49	1.5
Clarinda	54	— 3	29.7	0.50	4.5
Clearlake	46	— 7	23.4	T.	T.
Clinton	52	— 3	28.5	0.26	0.8
College Springs	56	— 2	30.0	0.42	3.1
Columbus Junction	56	1	29.4	0.12	0.5
Coon Rapids	52	— 4	27.5	0.38	3.0
Corning	52	— 2	29.0	0.12	1.2
Council Bluffs	60	0	31.4	0.56	3.5
Crawfordsville	.....	.....	.....	0.23	0.5
Cresco	46	— 4	21.6	0.80	1.0
Cumberland	.....	.....	.....	0.30	3.0
Danville	.....	.....	.....	0.11	0.1
Decorah	47	— 4	23.0	0.72	2.0
Delaware	50	— 9	24.8	0.58	5.0
Denison	55	— 4	27.4	0.20	2.0
Desoto	53	— 3	29.0	0.39	2.6
Dows	49	— 6	24.0	0.15	0.8
Eldon	56	— 1	29.4	0.46	1.3
Elkader	54	— 2	26.0	0.74	5.0
Emerson	.....	.....	.....	0.57	.....
Estherville	52	— 6	22.6	0.15	1.4
Fayette	49	—12	23.3	0.50	2.4
Fonda	.....	.....	.....	0.59	4.5
Forest City	47	— 8	23.0	0.14	T.
Fort Dodge	52	— 5	25.4	0.10	1.0
Fort Madison	.....	.....	.....	0.35	1.1
Fruitland	55	— 1	28.8	0.34	1.4
Galva	56	— 5	26.6	0.30	3.0
Gilman	.....	.....	.....	0.44	1.0
Glenwood	59	— 2	31.4	0.23	2.2
Grand Meadow[*1]	45	— 4	23.3	0.81	6.5
Greene	47	— 3	24.8	0.34	.....
Grinnell	52	— 2	27.6	0.70	.....
Grinnell (near)	52	— 3	26.4	0.90	5.0
Grundy Center	49	— 3	26.0	0.65	4.5
Guthrie Center	51[b]	— 5	29.3[a]	0.84	4.4
Hampton	50	— 5	24.4	0.38	1.2
Harlan	52	— 4	27.2	0.67	3.9
Hawkeye	.....	.....	.....	0.80	3.0
Hedrick	54	— 4	27.4	0.40	1.4
Hopeville	53	— 3	28.8	0.26	.....
Hoprig	.....	.....	.....	0.15	1.5
Humboldt	52	— 5	24.8	0.10	1.0
Independence	50	— 2	24.3	0.62	4.4
Indianola	53	— 3	27.5	0.28	2.0
Iowa City	54	1	27.6	0.75	2.0
Iowa Falls	48	— 5	24.2	0.55	5.5
Keosauqua	57	3	30.8	0.58	1.0
Lacona	.....	.....	.....	0.38	2.3
Lansing	52	0	26.8	0.37	2.6
Larrabee	53	— 7	25.4	0.33	3.4
Leclaire	.....	.....	.....	0.20	0.5
Lemars	52	— 5	26.0	0.20	2.0
Lenox	51	— 5	27.4	0.24	1.1
Logan	54	— 6	26.4	1.08	10.0
Maple Valley	.....	.....	.....	0.34	2.5
Marshalltown	53	— 4	27.1	0.87	3.7
Monticello	50	0	25.0	0.30	3.0
Mooar	55	10	29.5	T.	
Mountayr	53	— 3	29.1	0.38	2.0
Mount Pleasant	57	2	30.6	0.17	.....
Mount Vernon *b*	53	— 6	26.2	0.56	3.2
New Hampton	49	— 5	22 8	0.72	0.1
Newton	54	— 5	27.0	0.97	4.0
Northwood	45	— 6	22.6	0.10	1.0
Odebolt	52	— 4	26.8	0.50	3.0
Ogden	51	— 6	24.5	0.16	0.5
Olin	52	1	27.6	0.20	2.0
Onawa	57	— 2	28.8	0.41	.....
Osage	43	— 6	22.8	0.26	1.3
Osceola	54	— 4	28.7	0.26	2.0
Oskaloosa	55	— 3	28.1	1.10	2.3
Ottumwa	58	0	30.4	0.47	0.2
Ovid	56	— 4	29.4	0.64	1.2
Pacific Junction	57	— 1	31.0	0.39	1.9
Pella	54	— 6	27.4	0.13	1.2
Perry	55	— 7	28.2	0.20	2.0
Plover	53	— 6	26.6	0.25	2.5
Primghar	60	—10	24.8	0.20	2.0
Redoak	56	— 4	29.4	0.43	2.3
Ridgeway	52	— 6	26.3	1.25	1.3
Rockwell City	53	— 5	26.3	0.63	5.2
Ruthven	44	— 9	21.8	0.21	1.5
Sac City	52	— 4	27.0	0.34	3.4
Scranton	51	— 3	28.2	0.25	3.0
Sheldon	48	— 9	25.2	0.50	5.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sibley	50	−10	24.6	0.57	3.2
Sigourney	57	− 1	28.8	0.56	T.
Sioux Center	47	−10	25.4	0.60	1.0
Spirit Lake [f]	50	−10	20.1	.....	.....
Storm Lake	50	− 7	25.0	0.34	2.5
Stuart	58	− 6	26.7	0.10	1.0
Thurman	54	− 2	30.4	0.22	0.5
Toledo	57	− 2	28.0	0.65	6.5
Villisca	55	− 4	31.6	1.33	7.0
Vinton [*1]	53	− 5	26.1	2.70	2.0
Wapello	54	6	31.4	0.35	0.8
Washington	56	− 4	27.2	0.30	0.5
Washta	.....	.....	.....	0.40	4.0
Waterloo	51	− 7	26.3	0.98	2.7
Waverly	52	− 3	25.2	0.67	2.9
Westbend [*1]	50	− 6	23.6	0.48	4.0
Westbranch	48	2	28.4	0.10	1.0
West Union	.....	.....	.....	0.35	3.5
Whitten [g]	49	− 5	27.0	T.	T.
Wilton Junction	54	0	28.5	0.35	2.0
Winterset	54	− 3	28.4	0.23	1.0
Woodburn	.....	.....	.....	0.35	2.0
Kansas.					
Abilene	59	3	35.2	0.82	1.0
Achilles	69[c]	−13[c]	32.2[c]	0.54	5.3
Altoona	61	7	37.0	0.51	T.
Anthony	.....	.....	.....	0.18	.....
Atchison *a*	59	2	34.2	0.26	2.0
Beloit	57	− 4	33.5	0.10	1.0
Burlington	61	5	36.2	0.05	T.
Campbell	57	0	33.0	0.93	2.0
Chanute	58	9	38.5	0.05	.....
Colby	70	−15	33.8	0.39	3.5
Columbus	63	9	37.9	0.57	T.
Coolidge	68	−14	32.2	T.	T.
Delphos	66	0	34.6	0.33	0.2
Dresden	63	− 8	35.0	0.30	2.0
Ellinwood	70	− 3	35.0	0.12	T.
Emporia	63	5	37.4	0.15	T.
Englewood	73	− 6	35.8	0.01	0.1
Eureka	.....	.....	.....	0.40	.....
Eureka Ranch	68	−11	33.6	0.25	2.0
Fallriver	63	8	37.0	0.35	T.
Fanning	58[c]	− 7[c]	31.3[c]	0.55	4.0
Frankfort	62	0	34.6	0.70	1.0
Garden City	72	−11	33.7	0.40	1.0
Gove	.....	.....	.....	0.20	2.0
Grenola	63	7	36.9	0.36	T.
Harrison	70	1	33.9	0.34	0.5
Horton	56	0	33.4	0.30	2.0
Hoxie	70	−12	35.4	0.40	4.0
Hutchinson	65	0	35.9	0.35	T.
Independence	62	9	38.5	0.52	T.
Jetmore	.....	.....	.....	0.07	0.5
Lakin	70	− 9	35.4	0.21	1.0
Lawrence	62	2	35.8	0.36	0.5
Lebanon	61	− 3	33.4	0.10	1.0
Lebo	57	4	35.4	0.22	T.
Little River	65	0	35.4	0.18	0.1
Macksville	73	− 5	36.2	0.07	0.2
McPherson	62	2	35.9	0.82	.....
Madison	62	− 1	35.6	0.40	0.0
Manhattan *b*	68	2	35.2	0.41	0.3
Manhattan *c*	68[c]	2	34.8[c]	0.41	0.3
Marion	57	3	36.2	0.75	1.0
Medicine Lodge	66	− 3	36.3	0.08	T.
Minneapolis	64	− 1	34.2	0.32	1.0
Moran	58	5	36.2	0.48	T.
Mounthope [*1]	58	3	36.0	0.47	T.
Ness City	66[c]	− 7[c]	35.8[c]	0.10	T.
Newton	61	1	33.8	0.84	0.1
Norwich	64	2	38.5	0.34	.....
Oberlin	.....	.....	.....	0.30	2.0
Olathe	60	2	37.4	0.25	2.5
Osage City	62	1	34.8	0.39	0.4
Oswego	63	9	39.2	0.63	.....
Ottawa	58	3	33.4	0.36	0.6
Phillipsburg	56	− 2	28.0	0.20	2.0
Rome	68	7	38.3	0.56	T.
Salina	61	− 1	33.6	0.43	0.5
Scott	66	−21	31.6	T.	T.
Sedan	63[j]	8[j]	35.6[j]	0.73	T.
Seneca	63	0	34.2	0.47	1.8
Toronto	63	6	36.2	0.20	.....
Tribune	.....	−15	.....	T.	T.
Ulysses	78	−14	34.0	0.01	0.1
Valley Falls	57	0	34.6	0.19	1.4
Viroqua	72	−10	36.0	0.20	2.0
Wakeeney (near) [*1]	64	−10	31.1	0.22	1.5
Wallace	.....	.....	.....	0.20	2.0
Wamego [*1]	62	2	33.7	0.47	0.9
Winfield	62	7	38.0	0.50	T.
Yates Center	60	4	35.0	0.50	T.
Kentucky.					
Alpha [*1]	.....	20	41.8	3.42	0.1
Anchorage	60	17	37.4	2.05	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	*Ins*	*Ins.*
Bardstown	64	17	39.4	2.54	0.5
Blandville	64	21	39.6	2.67	
Bowling Green	64	17	39.8	3.17	T.
Burnside	.....	.....	.....	2.98	0.2
Carrollton	58	15	35.2	1.38	T.
Catlettsburg	64	13	37.8	2.88	T.
Centertown	65	17	40.4	1.40	T.
Earlington	65	19	40.5	3.06	
Edmonton	62	15	39.4	3.09	0.1
Eubank	60	14	35.6	2.59	1.0
Falmouth	.....	.....	.....	1.75	T.
Fords Ferry	64	15	38.8	2.54	
Frankfort	59	20	38.5	1.96	
Georgetown	59	17	37.6	.....	.....
Greensburg	64	15	37.6	3.21	0.2
Henderson	62	15	38.4	2.30	T.
Hopkinsville	62	20	40.2	3.53	
Irvington	60	16	37.5	2.32	
Jackson	62	17	39.0	2.80	0.8
Leitchfield	61	17	38.2	3.21	0.8
Loretto	63	12	38.7	2.44	T.
Maysville	62	17	35.5	2.03	0.2
Middlesboro	65	15	39.4	5.86	0.1
Mount Sterling	57	18	36.0	3.27	0.7
Owensboro	63	21	40.6	2.48	
Owenton	58	15	35.2	1.44	
Paducah *a*	.....	.....	.....	2.51	
Paducah *b*	66	22	42.5	2.36	
Princeton	63	15	38.2	5.40	
Richmond	60	18	38.7	.....	
St. John	62	16	38.2	2.79	0.2
Scott	57	15	34.8	1.23	0.3
Shelby City	63	14	37.8	2.32	0.8
Shelbyville	59	18	36.6	2.33	T.
Vanceburg	58	15	35.6	2.50	
Warfield	70	15	38.5	2.65	0.5
Williamsburg	61	19	41.4	2.12	0.1
Louisiana.					
Abbeville	75	35	54.0	6.85	
Alexandria	74	28	51.8	4.81	
Amite	73	27	51.3	6.17	
Baton Rouge	73	31	52.4	6.59	
Burnside	75	30	53.2	8.03	
Calhoun	.....	23	.....	1.97	
Cheneyville	73	30	50.6	6.26	
Clinton	71	27	51.6	5.69	
Como	.....	.....	.....	3.36	
Covington	78	28	51.6	6.41	
Donaldsonville	78	33	55.8	10.45	
Emilie	70	32	52.4	7.17	
Farmerville	73	32	49.3	1.60	
Franklin	72	32	52.5	5.81	
Grand Coteau	72	33	52 2	10.97	
Hammond	75	28	52.4	6.95	
Houma	80	32	56.0	12.02	
Jeanerette	74	32	53.6	5.85	
Jennings	75	32	53.3	9.56	
Lafayette	75	31	52.2	6.55	
Lake Charles	74	32	52.6	6.95	
Lawrence	73[c]	36[c]	54.6[c]	5.53	
Libertyhill	77	26	49.2	1.89	
Mansfield	75	25	48.2	2.24	
Melville	74	28	52.8	7.30	
Minden	74	26	49.0	3.30	
Monroe	75	31	51.9	1.57	
New Iberia	73	34	53.4	7.00	
Opelousas	74	30	52.0	7.67	
Oxford	75	24	48.2	2.34	
Paincourtville	75	30	54.0	7.94	
Plain Dealing	74	25	47.0	1.93	
Prevost	.....	.....	.....	4.08	
Rayne	69	32	53.4	.....	
Ruston	73	.....	.....	1.79	
Schriever	80	28	53.5	6.13	
Southern University	75[j]	32[j]	52.0[j]	7.88	
Sugar Ex. Station	72	35	56.4	8.64	
Sugartown	71	32	52.4	5.78	
Venice	73	34	56.8	6.71	
Wallace	74	29	53.6	12.69	
White Sulphur Springs	.....	.....	.....	3.92	
Maine.					
Bar Harbor	52	− 3	25.0	2.43	5.5
Belfast [*6]	45	− 8	21.3	1.68	4.0
Bemis	46	−14	17.5	1.82	20.0
Carmel	47	−20	18.2	1.99	8.0
Cornish [*1]	46	− 3	23.0	3.39	10.8
Fairfield	43	−18	19.0	2.19	13.0
Farmington	40	−18	18.0	1.77	18.0
Flagstaff	48	−28	20.6	2.45	24.5
Gardiner	45	− 5	22.2	1.64	5.5
Lewiston	46	− 3	22.8	2.13	6.0
Mayfield	49	−12	20.0	1.10	12.0
North Bridgton	47	− 9	22.7	1.42	10.5
Orono	45	−16	18.4	2.02	11.8
Rumford Falls	42	−11	18.8	1.15	13.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maryland.	°	°	°	*Ins.*	*Ins.*
Annapolis	58	16	36.4	3.00	3.0
Bachmans Valley	52	9	31.8	3.14	T.
Boettcherville	56	9	33.8	1.62	
Boonsboro *a*	60	10	34.8	1.88	
Charlotte Hall	65	11	36.0	2.89	3.0
Chase	53	10	31.0	1.96	T.
Chestertown	57	15	36.0	2.50	1.8
Chewsville	58	8	34.6	1.59	.....
Clearspring	56	9	33.2	1.51	1.3
Coleman	.....	.....	.....	3.22	2.0
Collegepark	62	9	34.9	2.40	T.
Cumberland *a*	56	12	34.4	1.69	.....
Cumberland *b*	.....	.....	.....	1.69	0.5
Darlington	58	12	33.8	2.46	
Deerpark	55	0	28.3	2.66	6.0
Easton	60	12	36.0	2.49	7.2
Ellicott City	.....	.....	.....	1.76	
Fallston	59	12	35.0	2.49	T.
Frederick	58	13	36.2	2.49	
Frostburg	61	7	31.7	2.08	3.5
Grantsville	57	3	29.9	2.52	7.0
Greatfalls	57	10	32.2	2.29	
Greenspring Furnace	55	10	33.1	1.80	T.
Hagerstown	68	10	34.7	1.81	T.
Hancock	58	7	33.0	2.79	
Harney	.....	.....	.....	2.34	0.5
Jewell	60	14	37.6	3.06	2.5
Johns Hopkins Hospital	61	11	34.2	2.19	T.
Laurel	64	10	34.8	2.51	T.
McDonogh	.....	.....	.....	2.42	
Mount St. Marys Coll	56	11	34.6	4.10	T.
Newmarket	56	10	34.0	2.67	T.
Pocomoke	65	16	39.2	2.69	
Princess Anne	65	17	37.0	2.48	2.0
Rockhall *b*	60	14	36.0	2.22	2.0
Sharpsburg	56	11	34.1	1.69	T.
Smithsburg *a*	56	8	34.4	1.52	T.
Smithsburg *b*	57	8	34.0	1.71	T.
Solomons	61	20	40.7	2.39	2.5
Sudlersville	66	10	37.5	2.41	3.8
Sunnyside	58	− 2	27.2	4.06	8.0
Takoma Park	62[j]	11	33.8[c]	2.72	T.
Taneytown	54	10	33.5	2.19	T.
Van Bibber	57	13	33.8	2.38	0.1
Westernport	52	9	30.0	2.21	1.2
Westminster	55	9	33.7	2.44	
Woodstock	57	14	33.8	2.35	
Massachusetts.					
Amherst	55	4	29.4	2.86	1.0
Bedford	55	4	29.7	1.54	0.8
Bluehill (summit)	55	4	30.1	2.46	2.7
Cambridge	60	6	32.0	2.53	.....
Chestnuthill	56	6	31.0	2.85	0.5
Cohasset	.....	.....	.....	2.90	T.
Concord	58	0	28.9	2.32	1.9
East Templeton [*1]	50	0	26.1	1.54	3.0
Fallriver	54	10	33.2	2.81	3.5
Fitchburg *a* [*1]	53	0	28.2	3.57	3.0
Fitchburg *b*	54	0	28.4	2.80	1.7
Framingham	57	8	30.4	2.54	.....
Groton	54	− 1	27.4	2.95	3.5
Hyannis [*1]	51	11	35.2	2.58	3.4
Jefferson	.....	.....	.....	3.20	4.2
Lawrence	56	2	28.6	2.41	1.5
Leeds	54	− 3	27.3	2.95	1.0
Leominster	.....	.....	.....	3.03	3.5
Lowell *a*	53	4	29.2	3.01	.....
Lowell *b*	54	2	29.1	.....	.....
Middleboro	56	0	29.6	2.52	3.0
Monson	57	0	29.2	2.83	3.5
New Bedford *a*	55	10	33.5	2.69	3.0
Pittsfield	50	− 3	24.8	2.08	6.0
Plymouth [*1]	56	10	33.3	3.16	2.5
Princeton	.....	.....	.....	2.90	4.5
Provincetown	53	13	35.2	1.53	0.5
Salem	.....	.....	.....	2.11	1.8
Somerset [*1]	54	8	33.1	2.40	2.0
South Clinton	.....	.....	.....	3.34	4.0
Springfield Armory	60	4	29.8	2.76	2.0
Sterling	.....	.....	.....	3.17	2.0
Taunton *c*	55	− 2	29.8	2.91	.....
Westboro	55	0	32.0	2.79	1.5
Weston	58	5	30.8	2.60	1.4
Williamstown [*1]	51	0	25.6	1.54	5.3
Winchendon	.....	.....	.....	2.49	8.5
Worcester	55	5	30.1	2.59	3.0
Michigan.					
Adrian	54	4	28.6	0.27	1.2
Agricultural College	51	2	26.7	0.50	2.6
Allegan	44	9	30.0	0.60	2.0
Alma	51	3	27.6	0.30	2.0
Ann Arbor	54	5	29.0	0.43	2.2
Annpere	51	8	30.7	0.40	4.0
Arabela	50	2	27.2	0.62	2.0
Baldwin	50	− 9	27.1	0.45	2.0
Ball Mountain	52	3	27.9	0.33	2.6

TABLE II.—*Climatological record of voluntary and other cooperating observers.*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Baraga	42	12	27.6	0.64	7.8
Battlecreek	51	6	28.6	0.60	3.9
Bay City	50	10	30.0	T.	T.
Berlin	51	— 3	25.8	0.50	2.4
Berrien Springs	52	10	29.7	1.17	7.0
Big Rapids	50	— 3	25.4	0.48	T.
Birmingham	52	6	29.3	T.	T.
Boon	47	—12	23.2	1.66	13.9
Calumet	40	— 4	20.8	2.77	20.0
Carsonville	50	4	28.3	0.25	2.5
Cassopolis	47	0	23.0	0.15	1.5
Charlevoix	50	3	29.3	1.13	10.5
Chatham [8]	44	— 2	20.4	3.25	32.5
Cheboygan	52	— 3	26.2	0.80	4.5
Clinton	56	1	29.4	0.29	1.3
Coldwater	51	10[e]	29.0[e]	0.90	4.0
Deerpark [1]	47	— 3	27.9	0.74	5.6
Detour	42	— 5	25.0	0.75	7.0
Dundee	59	5	28.8	0.42	3.0
Eagle Harbor	41	0	25.2	0.87	5.0
East Tawas	44	10	30.2	0.13	1.3
Eloise	54	3	29.2	0.43	3.1
Fairview	48	— 3	26.3	0.28	2.8
Fitchburg	52	1	28.2	0.47	2.5
Flint	51	3	28.1	0.45	2.0
Gaylord	42	—12	22.2	1.50	15.0
Gladwin	52	— 2	26.5	0.10	1.0
Grand Rapids	51	5	29.7	0.88	5.5
Grape	56	4	30.2	0.51	2.0
Grayling	45	—13	23.6	1.45	7.0
Hanover	52	3	28.6	0.27	2.9
Harbor Beach	50	6	28.4	0.50	4.0
Harrisville	47	— 3	25.4	1.37	9.5
Hart	52	6	26.3	0.45	4.5
Hastings	59	3	28.0	0.63	4.5
Hayes	48	0	26.8	0.82	6.0
Highland Station	.....	.....	.....	0.40	4.0
Hillsdale	52	4	28.4	0.43	2.0
Humboldt	39	—18	17.4	0.45	2.0
Ionia	51	5	28.6	0.19	1.5
Iron River	38	—11	17.0	1.10	5.0
Ishpeming	41	— 2	20.0	0.50	0.5
Ivan	47	— 7	23.7	1.38	12.5
Jackson	53	6	29.6	0.28	1.5
Jeddo	50	7	28.5	0.79	4.8
Kalamazoo	50	8	28.4	0.38	2.0
Lake City	48	— 9	24.2	0.10	1.0
Lansing	51	5	27.7	0.47	3.0
Lapeer	51	2	28.0	.....	.....
Lathrop	42	— 6	22.1	1.25	2.5
Lincoln	46	3	26.7	0.05	0.5
Ludington	45	6	24.2	1.50	15.0
Mackinac Island	47	— 4	26.1	1.39	11.5
Mackinaw	47	— 7	26.2	1.20	8.0
Madison	53	3	29.0	0.41	2.6
Mancelona	45	— 9	24.2	3.00	28.0
Manistee	50	3	28.2	1.10	7.0
Manistique	42	— 4	25.6	1.27	7.5
Menominee	50	1	27.2	0.79	5.0
Middle Island [10]	43	9	27.5	.....	.....
Midland	53	2	29.6	.....	.....
Mottville	52	5	28.2	0.10	1.0
Mount Clemens [b]	53	5	32.9	0.06	0.3
Mount Pleasant	49	2	26.9	0.40	1.0
Muskegon	50	9	30.2	0.73	2.5
Newberry	40	0	20.6	0.55	5.0
North Marshall	50	5	29.6	.....	.....
Northport	52	6	28.8	1.73	15.0
Old Mission	50	2	28.4	1.17	8.0
Olivet	49	5	28.8	0.45	3.1
Omer	50	0	26.1	0.10	1.0
Onaway [3]	47	6	28.1	0.16	T.
Ontonagon	37	—10	19.8	1.41	6.5
Ovid	52	4	28.2	0.36	3.0
Owosso	53	3	27.6	0.30	T.
Petoskey	48	0	27.4	0.85	7.0
Plymouth	60	12	36.4	.....	.....
Port Austin	58	10	27.2	T.	T.
Powers	42	—15	27.8	.....	.....
Reed City	49	— 2	25.8	0.35	1.5
Roscommon	.....	.....	.....	0.80	8.0
Saginaw	53	6	28.4	0.48	2.9
St. Ignace	44	— 4	29.1	1.20	12.0
St. Johns	53	4	28.9	.....	.....
St. Joseph	55	11	32.6	0.01	T.
Sidnaw	52	—14	17.0	0.95	9.5
South Haven	53	10	30.1	0.59	1.0
Stanton	50	1	25.2	0.31	1.6
Thomaston	38	—12	16.6	2.00	20.0
Thornville	51	2	28.6	0.36	4.0
Traverse City	50	1	27.8	2.03	18.7
Vassar	52	2	28.0	0.66	1.7
Wasepi	52	6	28.4	0.54	2.0
Waverly	46	5	28.3	1.65	4.1
Whitecloud	50	— 1	27.2	0.30	3.0
Whitefish Point	40	— 4	23.6	1.05	6.3
Williamson	51	2	28.6	0.56	3.5
Ypsilanti	54	2	29.0	0.40	2.5
Minnesota.					
Ada	38	—26	14.8	0.06	0.2
Albert Lea	45	— 9	21.2	0.20	1.0
Alexandria	37	—22	17.4	0.51	5.1
Ashby	38	—15	17.2	0.51	5.2
Beardsley	51	—13	20.4	0.94	3.6
Beaulieu	44	—20	16.0	0.16	2.0
Bemidji	38	—23	16.8	0.45	4.2
Bird Island	38	—12	19.6	0.40	4.0
Blooming Prairie	44	—10	21.2	0.30	2.0
Brainerd	41	—23	16.8	1.21	7.0
Caledonia	45	— 4	23.3	0.42	0.7
Collegeville	42	—12	20.6	0.47	4.8
Crookston	36	—17	14.0	0.20	2.0
Currie [8]	46	—11	20.5	.....	.....
Deephaven	.....	.....	.....	0.55	4.5
Detroit City	39	—28	13.2	0.30	3.0
Faribault	46	—11	21.9	0.15	1.5
Farmington	44	—13	20.2	0.55	3.5
Fergus Falls	39	—15	16.6	0.30	2.4
Glencoe	42	—12	19.3	0.10	1.0
Grand Meadow	40	—11	19.3	1.31	2.0
Hallock	35	—27	11.4	0.16	1.6
Hovland	.....	.....	.....	0.69	5.2
Lake Jennie	43	—15	19.8	0.35	3.5
Lakeside	40	—13	18.5	0.65	6.5
Lake Winnibigoshish	43	—33	15.2	0.66	7.6
Leech [1]	44	—32[e]	14.9	1.03	11.0
Leroy	42	—10	20.7	0.90	.....
Long Prairie	38	—25	16.2	0.47	3.0
Luverne	49	— 9	23.6	0.18	1.8
Lynd	45	—13	22.4	0.65	7.5
Mapleplain	44	—15	19.1	0.72	7.0
Milan	48	—17	18.6	1.17	7.7
Minneapolis *a*	42	—13	19.9	0.42	4.2
Minneapolis *b* [1]	42[e]	—12	20.6	0.41	2.5
Montevideo	44	—15	20.4	0.56	4.5
Morris	42	—15	17.8	0.30	1.5
Mount Iron	44	—31	12.6	0.30	3.0
Newfolden	38	—25	10.7	0.16	.....
New London	38	—20	15.5	0.20	2.0
New Richland [8] [1]	42	—10	21.8	.....	.....
New Ulm	46	— 9	22.5	0.40	4.0
Park Rapids	38	—23	15.2	0.48	3.8
Pine River	41	—26	15.2	0.53	5.6
Pipestone	41	—11	21.0	0.41	4.0
Pleasant Mounds	49	—10	22.8	0.55	5.0
Pokegama Falls	40	—45	11.6	0.71	5.7
Redwing	.....	.....	.....	0.75	3.8
Reeds	.....	.....	.....	0.90	2.5
Rolling Green	42	— 8	22.5	0.40	4.0
St. Charles	43	— 7	22.0	0.66	2.0
St. Cloud	46	—16	20.2	0.86	9.0
St. Peter	47	—10	22.0	0.50	4.0
Sandy Lake Dam	44	—29	14.8	0.68	6.7
Shakopee	42	—11	21.0	0.52	4.5
Tower	41	—35	14.0	0.60	6.0
Two Harbors	40	—21	19.2	0.18	3.0
Wabasha [8] [1]	44	— 9	22.6	0.66	4.6
White Bear	.....	.....	.....	0.38	2.9
Willmar	40	—14	18.2	0.90	2.5
Willow River	46	—25	18.2	0.37	3.6
Winnebago City	48	—10	21.7	0.82	8.5
Worthington	45[e]	—12[e]	23.7[e]	0.39	3.5
Zumbrota [1]	44[e]	—13	21.5	.....	.....
Mississippi.					
Agricultural College	67	29	46.7	3.15	
Austin	67	26	45.4	4.82	
Batesville	64	25	43.1	4.62	
Bay St. Louis	68	34	52.7	7.02	
Biloxi	60	35	48.8	8.33	
Booneville	62	26	43.8	3.63	
Brookhaven	78	24	50.4	5.10	
Canton	71	26	48.8	3.22	
Columbus *a*	.....	.....	.....	2.78	
Columbus *b*	64	26	45.1	2.78	
Crystalsprings	71	29	49.4	4.34	
Edwards	70	29	49.6	3.06	
Fayette	72	27	49.2	3.30	
Fayette (near) [8] [1]	70	32	50.3	3.42	
Greenville *a*	66	35	47.8	3.46	
Greenville *b*	71	30	47.2	3.43	
Hernando	65	27	44.5	3.69	
Holly Springs	65[e]	26[e]	44.9[e]	5.23	
Kosciusko	70	27	49.2	2.30	
Latonia	74	30	52.9	6.42	
Leakesville	78	25	49.4	8.76	
Logtown	72	32	51.8	5.91	
Louisville	67	25	47.6	2.71	
Macon	63	30	48.5	1.27	
Magnolia	72	27	50.0	5.58	
Natchez	72	28	51.8	3.50	
Okolona	65	29	47.2	3.01	
Palo Alto	70	26	47.6	3.56	
Pontotoc	67	27	45.3	2.18	
Port Gibson	73	25	50.0	3.21	
Ripley	67	25	43.8	4.28	
Saratoga	69	25	48.9	5.48	
Shoccoe	.....	.....	.....	2.40	
Stonington [8] [1]	70	30	49.1	.....	
Thornton	.....	.....	.....	3.56	
Tupelo	.....	.....	.....	4.05	
Walnutgrove	70	28	49.0	1.56	
Watervalley	.....	.....	.....	4.55	
Waynesboro	74	25	50.4	7.30	
Woodville	70	30	50.9	6.16	
Yazoo City	71	28	48.2	3.70	
Missouri.					
Appleton City	62	6	37.8	0.60	T.
Arthur	61	7	36.6	0.62	T.
Avalon	60	0	33.8	0.44	T.
Bethany	56	— 1	32.0	0.25	0.6
Birchtree	63	14	38.9	0.81	1.0
Boonville	.....	.....	.....	0.79	0.4
Brunswick	60	3	32.8	0.59	1.0
Carrollton	60	5	35.8	0.60	0.1
Conception	55	0	33.8	0.24	T.
Cook Station	63	5	36.6	0.30	
Cowgill [8] [5]	56	2	34.2	0.46	T.
Darksville	58	2	31.8	0.57	0.2
Downing	.....	.....	.....	0.18	T.
East Lynne [8] [3]	.....	7	32.8	0.36	0.4
Edgehill [8] [5]	52	10	34.0	1.24	1.0
Edwards	64	9	35.8	0.86	T.
Eldon	64	9	36.9	0.66	1.0
Elmira	60	1	33.2	0.45	T.
Fairport	.....	.....	.....	0.43	1.5
Fayette	62	3	34.4	0.98	1.8
Fulton	61	9	36.3	0.75	T.
Galena	.....	.....	.....	0.61	
Gallatin [8] [1]	54	0	33.4	0.39	1.5
Gayoso	63	24	42.2	2.58	
Glasgow	61	2	32.3	0.56	.....
Gorin	.....	.....	.....	0.30	T.
Halfway	63	9	39.2	0.51	1.0
Harrisonville	62	3	34.6	0.26	0.2
Hazlehurst	.....	.....	.....	1.01	1.0
Hermann	.....	.....	.....	0.51	0.1
Houston	62	10	38.6	0.38	T.
Houstonia (near)	.....	.....	.....	0.64	3.0
Irena	.....	.....	.....	0.27	1.0
Ironton	66	8	36.0	1.68	1.0
Jackson [8] [3]	59	20	35.3	1.51	
Jefferson City	60	9	36.2	.....	
Kidder	57	— 1	32.6	0.47	0.6
Koshkonong	66	18	42.1	1.76	T.
Lamar	63	8	38.7	0.35	T.
Lamonte	.....	.....	.....	0.61	1.5
Lebanon	61	15	38.4	0.64	T.
Lexington	61	4	35.2	0.58	T.
Liberty	60	— 1	33.6	0.08	0.6
Louisiana	62	10	35.6	0.34	T.
McCune [8] [1]	60	3	33.4	0.54	1.2
Macon	60	1	33.7	0.49	0.5
Marblehill	63	12	37.0	1.81	0.8
Marshall	61	0	32.7	0.55	1.3
Maryville	53	— 3	29.2	0.63	3.5
Mexico	61	9	34.3	0.31	0.5
Miami [8] [5]	58	3	33.3	0.39	1.
Mineralspring	63	13	41.2	0.45	T.
Montreal	61	10	37.0	1.22	T.
Mount Vernon	68	12	38.8	0.12	T.
Neosho	64	9	38.4	0.68	T.0
Nevada	.....	.....	.....	0.80	T.
New Haven	64	14	36.4	0.61	T.
New Palestine	62	5	37.2	0.17	0.3
Oakfield	63	11	37.4	0.60	1.5
Olden	64	13	39.0	1.04	T.
Oregon *a*	56	0	33.6	0.53	3.4
Oregon *b*	.....	0	.....	0.35	2.2
Palmyra [8] [5]	58	6	32.4	0.45	1.5
Pine Hill	.....	.....	.....	1.21	0.4
Poplarbluff	67	18	43.4[f]	2.37	
Potosi	63	0	32.9	0.91	T.
Princeton	56	— 2	31.6	0.70	T.
Richmond	60	3	34.8	0.62	0.5
Rockport	.....	.....	.....	0.65	3.5
Rolla	.....	.....	.....	0.89	0.6
St. Charles	63	14	36.4	0.85	1.5
St. Joseph	.....	.....	.....	0.14	0.4
Sarcoxie [8] [3]	.....	12	34.2	0.55	T.
Sedalia	60	3	37.2	0.05	.....
Seymour	64	13	38.3	0.31	T.
Shelbina	.....	.....	.....	0.47	0.7
Sikeston	65	21	40.1	3.45	
Steffenville	59	3	33.5	0.15	0.5
Sublett	56	— 1	30.8	0.55	0.2
Trenton	54	0	32.4	0.94	1.0
Unionville	56	2	31.4	0.76	0.4
Vichy	63	11	37.7	0.70	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Warrensburg	61	3	36.5	0.34	0.8
Warrenton	61	11	33.4	0.65	2.5
Wheatland	.....	.....	.....	0.63	T.
Willowsprings	64	9	37.5	0.37	0.2
Windsor	63	4	36.1	0.67	2.1
Wylie	67	10	41.0	0.47	T.
Zeltonia	64	10	37.6	1.94	1.5
Montana.					
Bigtimber	60	— 5	36.6	T.	T.
Boulder	58	—17	30.0	0.37	3.0
Butte	54	—11	30.5	0.40	4.0
Clemons	58	—10	34.1	0.41	4.0
Columbia Falls	48	— 7	31.4	0.99	6.0
Corvallis	60	0	34.9	0.05	0.5
Crow Agency	60	—13	32.2	0.22	2.5
Culbertson	46	—13	21.0	0.20	3.0
Dell	41	—20	21.2	T.	T.
Dillon	58	—15	31.2	0.17	1.7
Fort Logan	54	—13	26.9	0.34	.....
Glasgow	50	—19	22.0	0.91	.....
Glendive	55	—14	28.1	0.17	1.2
Glenwood	57	—15	30.4	0.77	7.7
Greatfalls	60	3	37.3	0.30	1.5
Kipp	60	— 5	32.3	0.20	2.0
Livingston	59	— 2	37.2	0.40	4.0
Martinsdale	56	— 7	32.3	0.30	0.5
Marysville	55	—12	29.0	0.86	7.2
Missoula	48	— 2	29.9[a]	1.07	1.0
Ovando	56	—26	23.6	2.43	4.1
Plains	53	4	34.0	0.50	.....
Redlodge	53	—17	29.7	0.90	9.0
Ridgelawn	52	—14	24.6	0.17	1.8
St. Pauls	60	—11	32.2	0.15	3.5
Troy	51[b]	— 2[b]	32.5[b]	3.02	3.0
Twin Bridges[c]	53	—13	27.4	.....	.....
Utica	61	—15	32.0	0.21	2.0
Yale	58	— 5	32.2	T.	T.
Nebraska.					
Agate	.....	.....	.....	0.11	2.0
Agee	.....	.....	.....	0.17	1.0
Albion	66[d]	— 4[d]	32.1[d]	T.	T.
Alliance	.....	.....	.....	0.25	1.5
Alma	65	— 8	32.0	0.32	2.0
Ansley	66	—12	32.4	0.57	0.5
Arapaho *1	67	— 6	33.3	0.10	1.0
Arborville *1	58	— 2	29.8	0.82	2.0
Arcadia	68	0	33.8	T.	T.
Arlington	.....	.....	.....	0.80	5.0
Ashland *a*	67	— 2	32.4	0.68	1.0
Ashland *b*	.....	.....	.....	0.45	2.5
Ashton	.....	.....	.....	0.28	.....
Auburn	61	0	34.1	0.47	3.5
Aurora *1	64	1	31.0	0.61	0.5
Bartley	.....	.....	.....	0.18	.....
Beatrice	63	0	32.8	0.83	1.0
Beaver	70	— 8	35.6	0.28	2.0
Bellevue	.....	.....	.....	0.58	5.5
Benedict	.....	.....	.....	0.80	2.0
Benkleman	.....	.....	.....	0.18	1.8
Blair	60	— 3	30.2	0.47	3.4
Bluehill	.....	.....	.....	0.35	0.5
Bradshaw	.....	.....	.....	0.60	1.0
Brokenbow *1	60	— 2	31.5	T.	T.
Burchard	.....	.....	.....	0.50	5.0
Burwell	.....	.....	.....	T.	T.
Callaway	65	— 7	34.0	0.35	1.0
Camp Clarke	62	—21	30.7	0.68	3.0
Central City	.....	.....	.....	0.20	2.0
Chester	.....	.....	.....	0.78	2.0
Columbus	63	— 1	32.8	0.10	0.8
Crete	68	— 1	33.0	0.52	1.5
Culbertson	.....	.....	.....	0.41	2.0
David City	62	— 4	30.4	0.35	4.0
Dawson	66	1	35.0	0.37	0.8
Eden	.....	.....	.....	0.35	3.5
Edgar *a*	.....	.....	.....	0.02	0.2
Ericson	.....	.....	.....	0.18	1.8
Ewing	.....	.....	.....	0.07	0.7
Fairbury	69	— 6	33.0	1.04	3.2
Fort Robinson	62	—14	31.8	0.90	6.2
Fremont	60	— 3	30.0	0.66	4.5
Geneva	.....	.....	.....	0.83	1.2
Genoa	64	0	32.2	0.28	2.4
Gering	63	—15	32.4	0.37	2.5
Gosper	.....	.....	.....	0.20	1.0
Gothenburg	66	—18	32.8	0.30	2.0
Grand Island *a* *1	61	4	32.6	0.05	0.5
Grand Island *b*	66	— 1	33.2	0.41	4.1
Grand Island *c*	66	— 9	30.4	0.32	.....
Greeley	.....	.....	.....	0.05	0.5
Guide Rock	.....	.....	.....	0.58	2.0
Haigler	.....	.....	.....	0.30	3.0
Hartington	65	— 6	26.9	0.95	8.5
Harvard	66	— 2	32.8	0.56	0.3
Hastings *1	66	2	33.0	0.01	0.2
Hayes Center	.....	.....	.....	0.20	2.0
Hay Springs	62	—10	32.6	0.65	3.0
Hebron	68	1	33.8	0.91	1.5
Hickman	.....	.....	.....	0.58	2.0
Holdrege *1	62	12	38.3	0.20	2.0
Hooper *1	56	— 1	29.1	0.50	4.4
Imperial	70	—17	32.6	0.15	1.2
Johnstown	.....	.....	.....	0.04	0.4
Kearney	.....	.....	.....	T.	T.
Kennedy	65	—16	33.2	0.55	2.5
Kimball	63	—16	30.8	0.25	2.5
Kirkwood *1	62	— 6	28.0	0.33	1.5
Laclede	63	— 3	30.9	0.37	1.0
Lena	.....	.....	.....	0.17	1.0
Lexington	65	—17	31.5	0.47	3.0
Lincoln [d]	59	0	33.3	0.05	1.3
Lodgepole	70	—17	31.8	0.30	3.0
Loup	.....	.....	.....	0.17	.....
Lynch	65	— 8	31.2	0.26	1.3
Lyons	.....	.....	.....	0.56	4.5
McCook *1	62	—10	30.1	0.20	2.0
Madison	60	— 1	31.0	0.25	1.8
Madrid	.....	.....	.....	0.00	
Marquette	.....	.....	.....	0.73	3.0
Mason City	.....	.....	.....	0.30	1.0
Minden *a*	68	— 4	32.6	0.77	2.0
Monroe	.....	.....	.....	0.21	1.6
Nebraska City *b*	58	0	33.7	T.	T.
Nebraska City *c*	61	— 1	33.4	0.25	T.
Nemaha *1	60	2	36.4	0.14	
Nesbit	64	—15	31.6	0.03	0.5
Norfolk	60	— 4	30.0	0.17	3.0
North Loup	65	0	33.8	0.50	T.
Oakdale	59	— 2	29.8	0.10	0.5
Odell	.....	.....	.....	1.25	1.0
O'Neill	68	1	33.2	0.54	1.5
Ord	.....	.....	.....	0.21	.....
Osceola	.....	.....	.....	0.20	2.0
Ough	.....	.....	.....	0.33	1.0
Palmer *5	50	0	30.0	0.27	T.
Plattsmouth *b*	.....	.....	.....	0.25	2.5
Pleasanthill	.....	.....	.....	0.80	3.0
Ravenna *a*	66	— 4	33.2	0.25	1.0
Ravenna *b*	.....	.....	.....	0.15	T.
Redcloud *b* *1	62	— 4	30.9	0.48	1.5
Republican *1	66	—10	30.1	0.05	0.5
Rulo	.....	.....	.....	0.20	.....
St. Libory	.....	.....	.....	0.44	1.5
St. Paul	66	— 3	31.4	0.34	0.5
Salem *1	59	0	33.6	0.22	0.2
Santee	57	— 6	31.0	0.05	0.6
Schuyler	.....	.....	.....	0.55	5.0
Seneca *1	50	2	30.3	T.	T.
Seward	.....	.....	.....	0.24	1.0
Smithfield	.....	.....	.....	0.00	
Spragg	.....	.....	.....	0.01	0.1
Springview	65	— 8	31.7	T.	T.
Stanton *1	61	— 2	28.6	0.47	3.0
State Farm	68	0	33.8	0.51	5.0
Strang	.....	.....	.....	0.77	2.5
Stratton	.....	.....	.....	0.20	1.5
Superior *5	70	0	36.1	0.45	2.0
Syracuse	.....	.....	.....	0.15	T.
Tablerock	.....	.....	.....	0.27	2.5
Tecumseh *b*	60	2	36.9	0.10	1.0
Tecumseh *c*	.....	.....	.....	0.24	1.0
Tekamah	62	— 2	30.6	0.60	5.0
Turlington	62	— 1	32.0	0.34	3.0
Wakefield	61	— 4	30.5	0.32	3.0
Wallace	.....	.....	.....	0.15	1.5
Wauneta	.....	.....	.....	0.15	1.5
Weeping Water *1	65	— 2	27.8	0.58	5.0
Westpoint	59	— 3	30.7	0.46	5.5
Whitman	.....	.....	.....	0.01	0.1
Wilber *1	58	0	32.2	0.67	T.
Willard	.....	.....	.....	0.17	0.4
Wilsonville *1	62	—12	28.2	T.	T.
Winnebago	.....	.....	.....	0.05	0.5
Wisner	.....	.....	.....	0.35	4.0
Wymore	.....	.....	.....	T.	T.
York	.....	.....	.....	0.50	1.0
Nevada.					
Austin	53	1	34.2	0.09	
Battle Mountain *1	52	10	32.7	0.00	
Belmont	50	— 5	31.4	T.	T.
Beowawe *1	61	11	35.8	0.05	0.5
Candelaria	71	— 1	40.0	0.01	T.
Carlin *1	50	12	33.2	0.20	
Carson City	58	5	35.8	0.69	1.2
Clover Valley	56	— 4	30.0	0.32	
Cranes Ranch	.....	.....	.....	0.20	1.0
Duck Valley	55	5	33.6	0.03	0.5
Elko *1	51	— 3	27.2	0.05	0.5
Elko (near)	52	— 5	30.6	0.12	1.2
Ely	55	—10	30.2	T.	T.
Empire Ranch	54	—12	29.2	0.08	0.8
Fenelon *1	61	— 6	28.9	0.00	
Golconda *1	60	14	35.7	T.	
Halleck *1	56	— 1	30.2	0.00	
Hawthorne	64	3	36.1	0.00	
Hot Springs *1	58	4	33.8	T.	
Humboldt *1	53	10	31.4	T.	T.
Lee	.....	.....	.....	0.14	1.0
Lewers Ranch	58	5	37.3	2.05	5.0
Lovelocks *1	58	14	30.2	0.00	
Martins	64	3	37.0	0.59	
Mill City *1	56	14	35.0	T.	T.
Palisade *1	55	0	30.4	0.06	0.5
Palmetto	62	— 8	33.8	0.25	2.5
Reno State University	56	9	34.6	0.46	
Silverpeak	59	2	33.6	T.	
Sodaville	62	8	35.8	T.	
Tecoma *1	50	4	32.3	0.00	
Toano *5	42	6	27.8	0.00	
Tuscarora	57	— 5	29.5	0.60	8.5
Tybo	50	— 2	33.3	0.00	
Wadsworth *1	68	0	32.9	0.05	
Wells *1	56	6	32.3	0.00	
New Hampshire.					
Alstead	.....	.....	.....	2.23	8.0
Berlin Mills	50	—28	17.1	2.64	30.0
Bethlehem	47	—14	19.6	2.06	16.0
Brookline *1	56	— 4	26.8	3.41	5.0
Claremont	45	— 9	22.5	2.33	2.5
Concord	52	— 9	23.6	1.29	2.8
Durham	54	0	27.8	3.83	4.0
Grafton	49	—18	19.6	2.41	13.0
Hanover	42	—15	19.6	2.07	11.8
Keene	54	— 5	24.5	2.07	4.5
Littleton	43	—15	22.2	1.74	15.5
Nashua	57	0	27.7	2.96	3.8
Newton	57	1	27.6	2.06	0.5
North Conway	47	—13	30.6	2.06	6.0
Peterboro	48	—11	24.2	3.10	9.2
Plymouth	42	— 7	20.2	0.97	5.8
Sanbornton	48	— 8	21.8	1.87	12.0
Stratford	43	—20	19.3	1.87	16.0
New Jersey.					
Asbury Park	60	12	35.8	2.59	6.1
Bayonne	59	10	34.0	1.87	0.4
Belvidere	57	5	30.8	2.91	1.5
Bergen Point	59	10	34.0	2.39	0.2
Beverly	60	10	33.9	2.57	4.2
Billingsport *1	54	15	34.0	3.28	2.0
Bridgeton	60	9	35.6	3.26	7.5
Camden	56	11	34.0	2.73	3.7
Cape May C. H.	58	12	36.6	3.29	10.2
Charlotteburg	57	4	30.0	3.23	3.0
Chester	55	5	30.6	1.73	2.4
Clayton	55[b]	12[b]	33.8[b]	2.60	5.5
College Farm	58	8	33.0	2.37	0.8
Deckertown	57	3	30.6	2.20	1.5
Dover	57	6	30.3	2.30	1.5
Egg Harbor City	58	9	33.6	2.65	6.5
Elizabeth	60	9	33.2	2.38	.....
Englewood	58	10	34.2	2.27	0.5
Flemington	58	7	32.6	2.25	0.5
Freehold	56	8	33.2	2.16	4.0
Friesburg	59	11	35.2	2.95	4.7
Hammonton	.....	.....	.....	2.68	8.0
Hightstown	57	10	33.4	2.17	1.5
Imlaystown	58	10	34.8	2.28	0.7
Lambertville	57	10	33.3	2.61	0.5
Layton	55	— 2	28.5	3.21	1.5
Moorestown	58	10	34.2	2.81	4.3
Mount Pleasant	.....	.....	.....	3.13	12.2
Newark	60	8	32.8	1.75	T.
New Brunswick	60	8	33.5	2.33	0.7
Newton	57	3	30.0	2.58	2.5
Ocean City	58	7	35.1	3.30	12.0
Oceanic	57	12	34.0	2.99	4.1
Paterson	64	11	34.4	2.62	1.3
Perth Amboy	50	9	32.9	2.01	0.8
Plainfield	59	8	31.8	2.22	0.6
Rancocas	.....	.....	.....	2.63	4.8
Rivervale	61	2	30.4	2.35	1.0
Roseland	60	5	31.3	2.18	1.2
Salem	64	14	37.0	3.08	4.0
Somerville	61	7	32.4	2.18	T.
South Orange	58	9	32.4	2.16	0.5
Toms River	60	3	32.8	2.78	6.0
Trenton	58	12	36.7	1.47	0.1
Tuckerton	60	7	34.1	2.68	7.0
Vineland	59	8	35.2	2.76	7.5
Woodbine	60	9	36.4	3.97	11.1
New Mexico.					
Albert	73	0	41.0	0.20	2.0
Albuquerque	60	9	34.6	T.	T.
Aztec	58	— 2	29.0	0.12	1.2
Bellranch	.....	.....	.....	0.30	3.0
Bernalillo	60[1]	5[k]	34.3[l]	0.07	0.2
Bluewater	57	—15	28.4	0.80	8.0
Cambray	.....	.....	.....	0.10	1.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Mexico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Deming	.....	.....	.....	0.08	0.3
East Lasvegas	54	1	34.9	0.46	4.6
Engle	70[x]	15[x]	38.2[x]	0.01	0.1
Espanola	58	−10	30.4	0.33	3.5
Folsom	66	−14	30.2	0.48	6.6
Fort Bayard	64	11	39.7	0.16	1.6
Fort Stanton	66	− 1	36.2	0.36	4.1
Fort Union	69	− 6	35.0	0.30	3.0
Fort Wingate	69	0	36.0	0.20	2.0
Gage	.....	.....	.....	0.00	
Gallisteo	58	6	31.6	0.05	0.5
Gallinas Spring	66	4	38.0	1.15	6.0
Las Vegas Hotsprings	62	− 4	34.8	0.94	3.0
Lordsburg	.....	.....	.....	0.00	
Los Lunas	60	7	34.3	0.25	T.
Lower Penasco	73	11	39.8	0.60	6.0
Lyons Ranch	67	9	40.7	0.30	3.0
Mesilla Park	70	14	40.9	0.04	.....
Raton	63	− 7	32.4	0.40	4.0
Roswell	74	7	41.1	0.07	1.0
San Marcial	76	8	42.7	0.55	5.5
Socorro	69	8	35.2	0.28	2.8
Springer	67	−13	32.2	T.	T.
Strauss	.....	.....	.....	T.	T.
Whiteoaks	60	7	36.0	1.15	11.5
Winsors Ranch	56	− 9	28.0	0.45	4.5
Woodbury	60	3	33.6	0.60	6.0
New York.					
Adams	.....	.....	.....	5.04	75.5
Addison	54	3	29.4	1.66	7.6
Akron	.....	.....	.....	1.06	.....
Alden	54	− 2	29.8	1.40	7.0
Alfred	46	− 5	26.4	1.21	12.7
Angelica	51	−10	26.6	2.15	15.0
Appleton	52	− 2	30.2	1.18	7.0
Atlanta	50	− 4	26.2	1.87	15.0
Auburn	54	4	28.8	2.40	9.5
Avon	55	− 6	29.5	1.56	.....
Axton	45	−27	19.4	1.26	12.2
Baldwinsville	50	3	27.2	3.09	17.7
Bedford *a*	.....	.....	.....	2.54	0.8
Bisby Lodge	.....	.....	.....	3.19	28.9
Bolivar	52	− 7	26.6	1.81	13.0
Boucksville	43	−12	22.8	3.72	29.2
Boyds Corners	.....	.....	.....	2.58	.....
Brockport	50	2	28.8	2.57	9.0
Caldwell	54	− 6	25.4	2.38	3.2
Canaan Four Corners	52	− 6	25.2	2.14	9.2
Canajoharie	46	−16	23.8	2.18	9.2
Canton	45	−19	20.0	1.30	13.0
Carmel	57	5	29.8	2.77	1.8
Carvers Falls	45	− 5	24.1	1.53	.....
Catskill	52	1	29.2	1.64	T.
Cedarhill	55	− 1	28.4	1.70	1.5
Charlotte[*12]	41	4	25.8	.....	.....
Cooperstown	45	− 9	24.5	2.59	13.0
Cortland	.....	.....	.....	2.58	12.5
Cutchogue	56	12	34.4	2.84	3.0
Dekalb Junction	.....	.....	.....	2.26	19.7
Elba	51	− 1	28.8	1.85	12.5
Elmira	51	6	30.6	1.72	7.5
Franklinville	55	−12	27.2	2.36	10.8
Fulton	.....	.....	.....	3.77	.....
Gabriels	39	−20	17.6	2.88	28.0
Glens Falls	50	− 3	25.4	2.04	6.4
Gloversville	46	− 8	22.2	2.12	6.8
Greenwich	48[o]	− 6[o]	24.1[o]	1.88	4.0
Griffin Corners	51	−12	25.0	1.93	12.1
Haskinville	.....	.....	.....	1.10	5.5
Honeymead Brook	53	0	27.2	2.50	3.3
Honnedaga Lake	.....	.....	.....	4.66	34.0
Humphrey	50	− 3	25.2	2.47	23.9
Indian Lake	55	−25	20.3	4.37	9.3
Ithaca	53	3	28.2	2.29	10.0
Jamestown	59	1	29.6	3.08	23.0
Jay	46	−25	19.4	3.63	37.0
Keene Valley	52	−23	21.0	3.01	35.0
King Ferry	.....	.....	.....	1.82	9.3
King Station	.....	.....	.....	3.47	7.5
Liberty	47	− 2	25.4	.....	.....
Littlefalls	44	−10	22.8	3.02	14.0
Lockport	51	4	29.7	1.80	8.0
Lowville	43	−18	21.3	2.32	23.0
Lyndonville	.....	.....	.....	1.59	.....
Lyons	52[l]	6[l]	29.8[l]	2.82	14.0
Mayle	.....	.....	.....	1.36	6.0
Meredith	44	−10	23.4	2.93	18.2
Middletown	58	4	28.8	3.17	3.3
Mohonk Lake	.....	.....	.....	2.66	3.0
Moira	45	−15	20.7	1.65	11.0
Newark Valley	.....	.....	.....	2.52	11.0
New Lisbon	47	−15	22.2	2.54	13.0
North Germantown	.....	.....	.....	2.13	.....
North Hammond	40	−10	23.0	1.20	10.2
North Lake	42	−18	17.3	2.00	.....
Number Four	43	−21	20.0	3.23	30.4

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ogdensburg	45	−10	21.8	0.89	8.3
Old Chatham	.....	.....	.....	2.08	5.9
Oneonta	.....	.....	.....	2.06	12.0
Oxford	47	− 8	24.3	3.43	14.5
Palermo	45	0	24.6	3.81	10.0
Penn Yan	52	3	28.6	1.78	7.5
Perry City	47	− 1	26.0	2.42	11.7
Plattsburg Barracks	42	−10	19.7	2.83	20.0
Port Byron	49	3	28.1	3.19	16.0
Port Jervis	56	0	28.8	2.98	1.0
Primrose	58	7	31.0	2.57	0.5
Richmondville	48	−18	20.3	1.96	13.5
Ridgeway	50	1	29.6	1.87	8.8
Rome	44	− 9	22.0	4.26	17.0
Romulus	52	4	29.5	1.94	6.3
St. Johnsville	47	−10	24.6	2.73	6.7
Salisbury Mills	.....	.....	.....	2.16	.....
Saranac Lake	46[c]	−22[c]	19.1[c]	.....	.....
Saratoga Springs	55	− 5	25.2	2.46	7.0
Schenectady	52	− 2	25.6	2.05	4.0
Setauket	57	14	35.2	2.63	0.7
Shortsville	53	3	28.7	0.90	3.7
Skaneateles	.....	.....	.....	3.00	.....
South Berlin	52	− 8	25.1	3.00	10.0
South Canisteo	50	− 3	26.4	1.60	15.0
Southeast Reservoir	.....	.....	.....	2.47	.....
Southampton	55	13	34.4	2.40	T.
Straits Corners	48	− 1	26.0	2.73	18.7
Ticonderoga	49	3	26.4	1.39	6.0
Volusia	48	0	28.0	3.25	.....
Walton	50	− 7	24.2	2.12	9.0
Wappingers Falls	55	2	28.8	2.27	4.5
Warwick	.....	.....	.....	1.78	.....
Watertown	49	−11	24.6	2.67	28.0
Waverly	53	3	28.6	2.76	7.2
Wedgwood	50	− 2	25.6	2.53	21.0
Wells	52	−20	21.6	2.89	11.2
West Berne	51	−17	23.8	2.85	19.0
West Chazy	43	−18	20.2	.....	.....
Westfield *a*	54	3	32.4	.....	.....
Westfield *b*	50	1	30.0	1.70	.....
Westfield *c*	57	9	33.9	1.14	7.8
Windham	54	−17	24.8	2.30	10.5
North Carolina.					
Abshers	65	17	40.8	3.35	T.
Asheville	.....	.....	.....	3.46	T.
Biltmore	56	20	39.4	3.80	T.
Bryson City	.....	.....	.....	4.76	
Chapelhill	68	19	41.4	4.31	T.
Cherryville	62	23	42.2	4.80	0.2
Currituck	.....	.....	.....	2.86	
Edenton	75	18	42.8	3.60	
Fayetteville	74	20	43.6	4.89	
Flatrock	60	18	38.2	3.90	
Goldsboro	69	21	41.6	4.22	
Greensboro	63	21	40.4	3.12	
Henderson	68	19	42.2	2.98	T.
Hendersonville	66	20	40.5	4.98	
Henrietta	67	20	43.1	5.10	
Highlands	51	16	35.8	7.53	1.8
Horse Cove	56	26	40.6	6.67	0.2
Kinston	72	20	44.5	2.81	
Lenoir	60	19	39.8	5.06	T.
Linville	49	10	34.0	3.95	7.0
Littleton	68	17	40.5	3.90	1.0
Louisburg	68	16	40.4	3.51	0.5
Lumberton	68	23	42.7	5.28	
Marion	63	22	41.5	4.74	
Marshall	.....	.....	.....	3.09	T.
Mocksville	60	19	40.1	3.32	2.0
Moncure	66	20	41.2	3.95	T.
Monroe	67	20	41.0	5.17	
Morganton	61	19	41.4	4.40	
Mountairy	59	18	38.8	3.38	
Murphy	.....	.....	.....	5.45	
Newbern	76	19	46.8	4.77	
Oakridge	62	17	39.8	2.95	2.3
Patterson	.....	.....	.....	4.43	T.
Pittsboro	71	18	42.4	4.35	0.5
Rockingham	69	22	42.2	5.42	
Roxboro	64	17	41.1	3.08	2.5
Salem	59	19	39.5	3.80	1.0
Salisbury	66	20	41.4	6.35	T.
Saxon	60	20	40.6	3.67	4.0
Selma	72	19	41.2	4.53	
Settle	60	22	41.0	4.51	4.2
Sloan	73	19	44.0	6.35	
Soapstone Mount	66	17	39.2	4.29	1.0
Southern Pines *a*	69	21	44.5	5.78	
Southern Pines *b*	68	21	43.8	4.90	
Southport	71	24	48.4	5.00	
Springhope[*1]	62	20	42.3	3.90	1.0
Tarboro	71	15	41.8	3.21	T.
Waynesville	59	14	37.5	4.08	T.
Weldon *a*	67	20	39.6	3.14	T.
Weldon *b*	.....	.....	.....	3.27	.....

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Dakota.	°	°	°	*Ins.*	*Ins.*
Amenia	38	−17	14.8	0.29	2.9
Ashley	48	−22	18.6	0.29	1.0
Berlin	55	−16	19.2	0.92	9.2
Buxton	38	−24	13.7	0.75	7.5
Churchs Ferry	41	−23	12.6	0.47	4.7
Coalharbor	50	−10	20.0	0.30	3.0
Devils Lake	41	−20	11.8	0.06	0.6
Dickinson	53	−11	27.4	0.10	T.
Dunseith	40	−29	12.2	0.62	6.2
Ellendale	51	−14	21.5	T.	T.
Falconer	48	−10	22.0	T.	T.
Fargo	38	−17	14.8	0.12	1.2
Forman	43	−14	15.8	0.30	3.0
Fort Berthold	52	−14	24.5	0.40	4.0
Fort Yates	50	−10	22.6	0.13	1.3
Fullerton	50	−13	20.0	0.44	4.0
Gallatin	36	−24	11.6	0.46	4.6
Glenullin	51	−24	22.0	0.14	1.4
Grafton	38	−18	12.8	0.37	3.7
Hamilton	40	−20	10.3	0.23	2.3
Hannaford	38	−20	13.6	0.33	3.8
Jamestown	44	−29	14.0	0.50	2.9
McKinney	40	−17	15.6	0.19	1.9
Mayville	40	−14	17.6	0.26	2.6
Medora	57	−20	25.9	0.20	2.0
Melville	42	−15	17.6	0.32	0.2
Milton	34	−25	11.1	0.40	4.0
Minnewaukon	39	−23	12.8	0.41	4.2
Minto	39	−18	12.9	0.32	3.2
Napoleon	40	−18	16.7	0.25	2.5
New England	53	−14	24.2	.....	.....
Oakdale	52	−13	25.8	0.65	4.5
Pembina	37	−24	11.0	0.38	3.8
Portal	40	−17	16.2	0.40	4.0
Power	44	−16	17.4	0.25	2.5
Towner	39	−18	12.6	0.50	5.0
University	58	−17	16.2	0.20	2.0
Wahpeton	42	−15	17.2	0.20	2.0
Willow City	40	−25	12.8	.....	.....
Woodbridge	37	−28	11.8	0.85	8.5
Ohio.					
Akron	54	13	30.4	1.12	3.2
Annapolis	55	4	30.1	0.54	0.6
Ashland	54	9	29.4	2.11	12.8
Ashtabula	59	11	31.5	1.61	7.1
Atwater	.....	.....	.....	1.47	8.5
Bangorville	54	6	30.0	1.51	6.7
Bement	56	10	30.0	1.24	6.5
Benton Ridge	54	3	30.3	1.18	7.0
Bethany	54	11	33.8	1.12	1.0
Bigprairie	57	11	31.7	1.81	5.0
Binola	.....	.....	.....	1.13	12.0
Bladensburg	55	6	30.8	0.80	2.4
Bloomingburg	58	10	32.6	1.10	0.4
Bowling Green	58	4	30.6	1.00	7.0
Bucyrus	58	4	28.6	0.73	6.5
Cambridge	58	5	30.5	1.47	T.
Camp Dennison	56	16	34.4	1.21	0.2
Canal Dover	53	11	30.7	1.65	2.5
Canton	55	12	31.8	2.03	10.4
Cardington	56	5	30.1	0.83	6.0
Cedarville	.....	.....	.....	1.15	2.0
Celina	58	3	30.5	1.33	6.3
Circleville	56	11	32.4	0.50	T.
Clarksville	57	13	34.2	1.12	0.3
Cleveland *a*	57	15	32.6	1.24	9.5
Cleveland *b*	57	14	31.0	0.75	6.2
Coalton	59	10	34.6	1.69	1.0
Colebrook	56	7	29.8	1.34	11.1
Dayton *a*	.....	.....	.....	1.44	2.4
Dayton *b*	57	10	33.0	1.78	2.5
Defiance	59	4	30.8	0.59	2.0
Delaware	57	4	31.0	1.05	3.1
Demos	53	6	30.8	1.68	3.5
Elyria	56	8	29.9	0.91	6.8
Findlay	60	7	30.7	0.88	4.8
Frankfort	57	9	33.0	1.12	T.
Garrettsville	55	− 1	30.0	1.34	9.3
Granville	49	8	30.0	1.34	1.0
Gratiot	54	8	31.0	0.83	1.1
Green	61	9	36.4	2.08	T.
Greenfield	55	16	34.4	1.35	T.
Greenhill	54	2	29.2	1.36	5.5
Greenville	52	10	31.2	1.75	5.0
Hanging Rock	59	15	35.6	0.82	T.
Hedges	56	1	30.2	0.72	2.5
Hillhouse	57	− 2	29.4	1.54	14.0
Hillsboro	60	13	33.4	1.51	0.3
Hiram	54	11	29.6	1.37	7.5
Hudson	55	10	30.0	1.05	5.0
Jacksonboro	55	15	33.2	1.05	5.0
Kenton	59	8	32.0	1.01	5.4
Killbuck	53	11	30.7	1.32	3.0
Lancaster	58	10	33.4	0.97	0.5
Leipsic	55	2	28.8	0.75	5.5
McConnelsville	55	8	32.1	1.63	0.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mansfield	.....	.....	.....	1.62	8.9
Marietta	57	14	35.0	2.05	0.3
Marion	55	8	31.6	1.31	4.0
Medina	56	10	30.9	0.96	6.0
Milfordton	64	8	28.8	1.33	4.5
Milligan	56	4	31.4	1.12	T.
Millport	54	— 1	29.0	1.68	5.7
Montpelier	57	5	28.6	0.57	3.5
Napoleon	61	5	31.2	0.95	7.5
New Alexandria	53	13	32.0	1.50	1 0
New Berlin	54	10	31.0	1.08	5.0
New Bremen	54	7	31.0	1.09	.....
New Holland	57	10	32.7	1.18	0.2
New Paris	57	12	30.9	0.77	1.0
New Richmond	57	16	35.8	1.39	0.6
New Waterford	55	5	30.4	2.13	10.0
North Lewisburg	62	5	29.6	1.25	5.0
North Royalton	56	8	30.6	1.22	11.5
Norwalk	59	11	31.4	1.21	8.5
Oberlin	60	8	31.4	0.75	.....
Ohio State University	56	6	31.7	1.05	0.5
Orangeville	56	0	29.3	1.20	7.0
Ottawa	58	4	30 9	1.05	6.5
Pataskala	57	7	30.8	1.28	1.9
Perry	.....	.....	.....	1.78	10.0
Philo	54	10	31.7	0.79	T.
Plattsburg	54	10	31.4	1.45	2.0
Pomeroy	60	15	34.7	2.04	0.8
Portsmouth *a*	.....	.....	.....	2.46	T.
Portsmouth *b*	65	19	37.0	2.46	0.3
Pulse	.....	.....	.....	1.49	1.0
Richwood	57	4	30.2	0.94	5.8
Ripley	57	16	35.4	1.67	0.3
Rittman	56	8	32.9	1.80	3.5
Rockyridge	58[c]	10[c]	30.6[c]	0.81	6.3
Rosewood	55	8	31.6	0.81	4.0
Shenandoah	55	5	29.6	1.18	5.6
Sidney	55	8	30.6	1.24	3.3
Sinking Spring	55	17	34.0	1.35	1.0
Somerset	55	11	33.2	0.90	T.
Springboro	.....	.....	.....	1.72	.....
Springfield	.....	.....	.....	1.24	1.5
Strongsville	.....	.....	.....	0.94	10.0
Swanton	.....	.....	.....	1.03	2.0
Thurman	61	15	36.3	1.63	T.
Tiffin	55	12	32.0	0.92	5.4
Upper Sandusky	55	6	32.4	1.35	5.4
Urbana	52	9	30.5	1.15	3.5
Vermillion	60	9	30.2	1.53	11.5
Vickery	56	9	31.5	0.57	2.9
Walnut	.....	.....	.....	1.09	0.4
Warren	58	10	30.8	1.33	8.1
Warsaw	55	9	30.2	1.27	1.8
Wauseon	58	2	30.0	0.93	6.4
Waverly	58	14	34.4	1.95	1.3
Waynesville	55	13	32.4	1.23	1.5
Wellington	56	10	31.2	1.08	7.5
Westerville	55	8	32.2	1.10	T.
Willoughby	.....	.....	.....	0.99	5.5
Wooster	55	11	30 8	0.99	4.4
Youngstown	.....	.....	.....	1.07	3.5
Zanesville	.....	.....	.....	1.21	0.5
Oklahoma.					
Arapaho	69	8	40.6	0.25	T.
Beaver	65	0	33.8	0.09	0.5
Blackburn	65	10	39.2	0.14	
Burnett	69	15	42.8	0.38	
Clifton	68	12	43.9	T.	
Fort Reno	67	10	40.4	0.62	
Fort Sill	70	5	40.8	0.65	
Hennessey	67	8	42.6	T.	
Jefferson	68	1	37.8	0.55	
Jenkins	66	4	38.2	0.26	T.
Kenton	70	— 9	36.6	0.20	1.0
Kingfisher	67	10	40.4	0.43	
Mangum	70	11	43.8	0.20	
Newkirk	62	8	40.7	0.70	T.
Norman [d]	65	11	44.4	1.08	0.5
Pawhuska	63	10	40.8	0.10	T.
Perry	65	9	41.6	0.44	
Prudence	69	4	37.6	0.56	
Sac and Fox Agency	68	10	41.6	1.50	
Stillwater	67	11	41.7	0.21	
Taloga	.....	.....	.....	0.30	
Texmo	64	18	42.2	0.35	
Vittum	64	10	41.9	0.68	
Waukomis	68	9	40.6	0.20	
Woodward	71	2	40.6	T.	T.
Oregon.					
Albany *a* [1]	55	30	43.2	3.39	
Albany *b*	.....	.....	.....	5.09	
Alpha	58	27	44.8	10.80	0.3
Ashland *b*	60	30	41.4	2.41	0.7
Aurora [1]	62	30	45.4	5.87	
Aurora (near)	56	24	43.4	6.45	
Bay City	63	27	47.4	22.98	T.
Oregon—Cont'd.					
Brownsville [1]	64	28	48.7	4.98	
Bullrun	52	29	41.2	9.20	
Burns	57	1	31.4	0.90	6.5
Cascade Locks	58	30	46.0	10.96	
Comstock [1]	58	28	44.4	6.28	
Coquille	.....	.....	.....	5.79	
Corvallis	60	30	44.2	5.99	
Dayville	65	8	41.0	1.09	1.6
Ella	.....	.....	.....	0.70	
Eugene	64	27	44.0	6.65	T.
Fairview	.....	.....	.....	7.65	
Falls City	59	24	42.3	13.49	
Forest Grove	57	24	42.4	9.40	4.0
Gardiner	64	31	48.4	8.57	
Glenora	55	27	42.9	27.24	
Government Camp	68	10	38.4	6.79	19.0
Grants Pass	62	19	41.8	5.46	
Hare	66	28	48.0	11.58	
Harris	62	24	44.2	4.16	
Hood River (near)	65	21	41.6	5.45	
Jacksonville	60	20	40.4	4.87	T.
Joseph	55	0	30.0	0.57	4.0
Junction City [1]	60	28	45.4	4.35	
Kerby	60	19	42.0	12.43	
Klamath Falls	48	11	34.0	.....	
Lafayette [1]	58	28	44.4	6.11	
Lagrande	53	10	37.4	1.98	1.0
Lakeview	65	6	36.1	1.03	3.8
Lonerock	66	10	36.8	2.19	2.5
McMinnville	59	26	43.4	7.01[a]	
Merlin [1]	70	22	43.4	6.00	
Monmouth *a* [1]	56	26	43.5	6.00	
Monroe	60	26	44.6	7.13	
Mount Angel	60	26	43.4	6.19	
Nehalem	.....	.....	.....	23.44	0.2
Newberg [d]	56	23	43.2	6.71	
Newbridge	55	9	34.2	0.33	0.5
Newport	64	32	48.9	8.83	
Pendleton	66	14	42.6	1.20	
Placer	.....	.....	.....	6.95	
Prineville	70	9	42.0	0.66	T.
Riddles [1]	64	24	42.6	6.00	
Riverside [h]	58	19	36.0	0.46	1.0
Salem *b*	.....	25	.....	6.86	
Sheridan [1]	54	28	41.8	7.24	
Silverlake	66	0	35.2	0.95	1.0
Silverton [1]	60	28	44.8	5.44	
Sparta	50	2	29.2	3.37	14.0
Springfield [1]	59	27	43.8	6.70	
Stafford	58	24	43.4	7.67	
The Dalles	59	23	42.6	1.33	
Toledo	67	27	47.6	7.32	T.
Umatilla	.....	.....	.....	0.89	0.5
Vale	54	9	32.6	0.53	0.5
Westfork [1]	54	24	39.5	9.03	
Williams	61	20	41.7	6.24	T.
Pennsylvania.					
Aleppo	59	9	33.4	1.07	2.0
Altoona	53	4	30.2	1.50	.....
Athens	53	4	29.1	2.14	7.6
Beaver Dam	.....	.....	.....	1.39	2.0
Bellefonte	50	7	32.0	2.24	3.0
Bethlehem	.....	.....	.....	2.04	.....
Brookville	.....	.....	.....	1.56	5.9
Browers Lock	.....	.....	.....	2.18	.....
Butler	52	2	29.6	1.79	9.6
Carlisle	51	12	32.8	1.43	0.5
Cassandra	50	5	28.6	1.16	9.5
Chambersburg	56	10	32.4	0.40	T.
Coatesville	61	11	34 3	2.47	0.4
Coopersburg	65	10	34.2	2.59	2.0
Davis Island Dam	.....	.....	.....	1.39	.....
Derry Station	60	10	32.6	2.77	2.5
Driftwood	.....	.....	.....	1.93	8.0
Duncannon	.....	.....	.....	2.13	T.
Dushore	47	0	27.8	2.09	2.1
Dyberry	51	— 1	25.8	2.78	5.2
East Bloomsburg	.....	.....	.....	0.80	1.6
East Mauch Chunk	56	7	30.4	3.27	2.5
Easton	51	8	31.6	2.32	1.8
Ellwood Junction	.....	.....	.....	1.80	7.5
Emporium	50	1	29.4	2.08	8.3
Ephrata	57	8	33.3	2.32	T.
Forks of Neshaminy [1]	48[e]	9[e]	30.2[e]	2.30	.....
Franklin	55	2	30.0	1.20	4.0
Freeport	.....	.....	.....	1.76	3.8
Girardville	.....	.....	.....	3.03	3.5
Grampian [1]	42	2	25.8	2.40	10.0
Greensboro	60	11	32.4	1.72	1.4
Hamburg	.....	.....	.....	2.95	2.5
Hawthorn	60	3	30.4	1.87	11.0
Herrs Island Dam	.....	.....	.....	1.54	.....
Huntingdon *a*	53	7	31.8	1.75	0.5
Huntingdon *b*	.....	.....	.....	1.38	.....
Irwin	.....	.....	.....	1.46	T.
Johnstown	57	9	32.4	2.57	3.7
Pennsylvania—Cont'd.					
Keating	.....	.....	.....	1.80	3.0
Kennett Square	60	11	34.4	2.42	0.4
Lancaster	65	10	36.2	4.00	.....
Lawrenceville	56	2	27.4	1.60	4.2
Lebanon	55	10	32.2	2.39	1.1
Leroy	49	— 1	27.0	2.12	8.9
Lewisburg	52	9	31.2	2.38	0.2
Lockhaven *a*	51	8	31.1	1.78	0.5
Lockhaven *b*	.....	.....	.....	1.70	T.
Lock No. 4	.....	.....	.....	1.86	0.2
Lycippus	63	7	31.8	2.37	4.8
Mifflin	.....	.....	.....	1.20	.....
Oil City	.....	.....	.....	1.63	8.5
Parker	.....	.....	.....	1.37	5.5
Philadelphia	59	13	37.0	2.66	1.9
Quakertown	56	8	31.6	2.64	2.0
Reading [g]	.....	.....	31.1	2.45	.....
Renovo *a*	.....	.....	.....	1.70	.....
Renovo *b*	50	8	30.2	1.57	2.4
Saegerstown	55	0	29.6	2.89	12.0
St. Marys	47	— 1	27.0	1.50	15.0
Selinsgrove	55	9	32.3	2.18	0.8
Shawmont	.....	.....	.....	2.28	.....
Sinnamahoning	.....	.....	.....	0.43	1.8
Smethport	52	— 2	27.4	0.40	4.0
Somerset	50	3	26.0	4.16	16.6
South Eaton	55	7	30.2	2.17	1.5
State College	50	6	30.0	1.77	1.6
Sunbury	.....	.....	.....	1.55	.....
Swarthmore	50	4	32.0	2.43	1.0
Towanda	51	4	29.8	1.99	2.8
Troutrun	.....	.....	.....	1.96	1.5
Uniontown	58	12	34.4	2.21	.....
Wellsboro	52	0	30.0	0.97	7.0
Westchester	56	11	34.2	2.50	0.5
West Newton	.....	.....	.....	1.93	.....
Wilkesbarre	52	9	31.6	3.02	1.5
York	54	10	33.0	2.52	0.7
Rhode Island.					
Bristol	53	9	34.1	2.09	2.0
Kingston	55	6	31.3	3.22	0.8
Pawtucket	58	13	34.6	2.60	.....
Providence *a*	58	10	34.0	2.79	T.
Providence *c*	58	8	32.3	2.88	T.
South Carolina.					
Batesburg	65	25	45.4	3.64	
Beaufort	70	31	51.4	4.06	
Blackville	70	27	46.8	7.80	
Calhoun Falls	.....	.....	.....	5.55	
Camden	.....	.....	.....	6.03	
Cheraw *a*	72	22	43.8	6.10	
Cheraw *b*	.....	.....	.....	5.81	
Clemson College	63[b]	22[b]	43.7[b]	3.99	
Conway	.....	.....	.....	6.55	
Darlington	.....	.....	.....	6.14	
Effingham	.....	.....	.....	8.15	
Gaffney	.....	.....	.....	5.09	
Georgetown	66	26	46.2	5.70	
Gillisonville	79	24	47.4	6.65	
Greenville	69	23	41.6	3.68	
Greenwood	65	29	44.3	5.69	
Holland	62	18	39.4	4.24	
Kingstree *a*	67	25	44.0	7.17	
Kingstree *b*	.....	.....	.....	7.80	
Liberty	64	21	42.4	4.51	
Little Mountain	66	28	45.6	4.93	
Longshore	66	25	44.0	4.96	
McCall	67	23	44.6	5.41	
Pinopolis [1]	68	30	47.8	5.72	
St. George	71	27	46.6	7.24	
St. Matthews	78	28	48.0	6.37	
St. Stephens	.....	.....	.....	7.89	
Santuck	66	21	43.2	4.05	
Shaws Fork	72	22	44.7	6.87	
Smiths Mills	.....	.....	.....	7.14	
Societyhill	68	25	44.9	6.25	
Spartanburg	66	24	42.0	4.45	
Statesburg	70	27	47.0	6.95	
Summerville	72	27	48.8	6.53	
Trenton	63	32	47.8	6.18	
Trial	72	22	44.7	7.55	
Walhalla	65	21	42.8	4.04	
Winnsboro	63	26	42.8	5.34	
Winthrop College	64	25	43.2	4.93	
Yorkville	65	29	45.8	4.56	
South Dakota.					
Aberdeen	56	—18	20.4	T.	T.
Academy	57	— 7	29.0	0.18	1.4
Alexandria	59	—12	25.1	T.	T.
Armour	58	—12	28.6	0.16	1.0
Ashcroft	59	—13	29.6	0.20	2.0
Bowdle	54	—19	21.7	0.05	0.5
Brookings	48	—12	21.5	0.64	6.0
Centerville	.....	.....	.....	0.38	4.1
Chamberlain	68	—12	29.0	0.13	1.1
Clark	54	—15	22.8	0.21	0.3

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins*
Desmet	57	−14	23.4	0.30	1.0
Doland	58	−16	24.6	0.25	0.6
Elkpoint	57	− 4	27.4	0.18	0.2
Farmingdale	.....	.....	.....	0.02	T.
Faulkton	59	−11	25.2	0.08	1.0
Flandreau	44	−13	21.8	0.50	5.0
Forestburg	53	−14	24.8	0.04	0.4
Fort Meade	50	− 4	34.2	0.70	6.0
Gannvalley	54	− 9	25.4	0.22	1.2
Gary	55	−14	23.8	0.32	4.0
Grand River School	.....	−10	.....	0.08	1.3
Greenwood	58	− 3	31.2	0.26	2.0
Hartman	52	−13	24.0	0.30	3.0
Highmore	60	−10	25.0	0.32	1.9
Hotch City	60	−17	28.9	0.10	2.0
Hot Springs[g]	57	− 7	29.0	0.30	3.0
Howard	57	−10	26.6	0.30	1.0
Ipswich	60	−17	23.0	0.02	0.5
Kimball	56	−10	28.1	0.10	0.6
Leola	58	−15	22.2	0.05	0.5
Leslie	55	−10	28.8	T.	T.
Mellette	55	−16	25.5	0.17	T.
Menno	55	− 9	26.6	0.07	0.6
Millbank	48	− 8	24.7	0.35	3.5
Mitchell	59	−10	27.8	0.00	
Mound City	59	−13	22.8	T.	T.
Oelrichs	61	−10	31.6	0.35	3.0
Parker	55	− 7	26.3	0.20	1.5
Plankinton	55	−11	25.2	0.05	0.5
Redfield	58	−15	25.3	0.06	0.5
Rochford	57	−12	27.6	0.47	2.5
Rosebud	56	−11	28.6	0.60	6.0
St. Lawrence	63	−16	27.8	0.02	0.2
Silver City	.....	.....	.....	0.07	0.1
Sisseton Agency	50	−12	21.0	0.27	.....
Spearfish	60	− 4	34.4	0.20	1.0
Tyndall	56	− 6	28.2	0.03	0.3
Vermillion	58	− 6	29.6	0.12	1.5
Watertown	55	−14	22.4	0.10	1.0
Waubay	47	−15	17.8	0.50	2.0
Wentworth	52	−12	22.5	0.26	2.6
Wessington Springs	53	−19	24.5	0.07	0.7
Wolsey	.....	.....	.....	0.07	0.5
Tennessee.					
Andersonville	64	17	41.4	2.35	
Ashwood	63	22	42.6	2.55	
Benton	64	21	42.6	4.30	
Bluff City	.....	.....	.....	2.65	T.
Bolivar	65	25	42.0	2.73	
Bristol	55	18	37.0	1 88	T.
Byrdstown	61	18	40.4	2.64	0.1
Carthage	63	.....	.....	2.65	
Charleston	.....	.....	.....	3.44	
Clarksville	64	22	41.4	2.67	
Clinton	.....	.....	.....	2.75	
Decatur	62	19	41.8	2 81	T.
Dickson	64	20	40.7	2.02	
Dover	70	18	42.0	3.06	
Elizabethton	60	15	37.6	3.31	0.5
Elk Valley	.....	15	.....	0.74	T.
Erasmus	61	13	38.4	2.95	
Florence	62	21	41.8	2.05	
Franklin	62	22	41.4	3.26	
Grace[*1]	64	20	42.8	2.50	
Greeneville	60	17	39.1	3.11	0.3
Harriman	62	20	41.0	2.81	
Hohenwald	63	17	39.4	2.61	
Iron City	63	20	41.3	3.27	
Jonesboro[*1]	58	21	37.5	3.13	1.0
Kingston	.....	.....	.....	3.72	T.
Lafayette[*5]	62	20	39.1	1.10	
Lewisburg	64	19	42.4	2.13	
Lynnville	60	24	42.4	1.81	
McKenzie	65	23	43.1	2.82	
McMinnville	65	18	44.0	3.05	
Maryville[*5]	64	21	42.0	3.26	T.
Newport	61	19	40.8	3.02	T.
Nunnelly	65	18	42.6	2.31	
Oakhill	64	17	41.6	3.53	T.
Palmetto	62	21	43 3	2.58	
Pope	68	17	43.3	2.38	
Rogersville	59	19	39.1	2.68	0.2
Rugby	60	12	38.4	2.41	
Savannah	66	22	42.8	3.20	
Sewanee	57	23	40.6	1.32	
Silverlake	59	14	35.2	2.56	1.0
Springdale	65	18	41.4	2.57	
Springfield	67	19	41.4	1.70	
Tazewell	.....	.....	.....	2.75	0.3
Tellico Plains	65	19	42.8	4.21	
Tracy City	57	17	39.2	3.19	
Tullahoma	60	17	40.6	2.50	
Union City	60	23	40.9	2.50	
Wildersville	64	24	43.4	2.98	
Yukon	61	24	43.4	3.19	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas.	°	°	°	*Ins.*	*Ins.*
Alvin	.....	.....	.....	2.64	
Anna	75	18	48.5	0.23	
Anson	.....	.....	.....	0.30	
Austin[a]	75	24	49.8	1.60	
Austin[b*5]	70	28	48.8	.....	
Ballinger	69	18	45.4	0.62	
Beaumont	78	38	56.0	.....	
Beeville	75	30	53.7	1.12	
Bigspring	.....	.....	.....	0.13	
Blanco	72	26	46.8	1.30	
Boerne[*1]	72	30	50.4	1.30	
Booth	.....	.....	.....	5.72	
Bowie	71	13	46.8	0.05	
Brazoria	78	32	53.9	2.18	
Brenham	75	34	52.8	1.55	
Brighton	85	32	58.4	2.10	
Brownwood	72	18	47.2	2.00	
Burnet[*1]	72	28	50.8	0.91	
Coleman	75	18	51.2	0.75	
Colorado	75[f]	13[f]	46.8[f]	0.18	
Columbia	77	37	52.7	1.77	
Corsicana	75	28	49.0	1.32	
Cuero	77	31	53.8	1.49	
Dallas	76	25	47.8	0.31	
Danevang	77	32	53.7	2.70	
Dublin	70	33	52.8	0 60	
Duval	75	32	52.2	1.83	
Estelle	76	30	49.1	0.30	
Fort Brown	87	25	59.4	1.74	
Fort Ringgold	90	30	58.1	1.30	
Fort Stockton	.....	.....	.....	0.00	
Fredericksburg[*1]	73[e]	26	47.8[e]	0.97	
Grapevine	77	20	49.2	0.24	T.
Hale Center	71	14	44.6	0.00	
Hallettsville	76	32	53.4	1.09	
Haskell	74	14	47.4	0.14	T.
Henrietta	72[a]	25[a]	47.0[a]	0.00	
Hewitt	.....	.....	.....	0.93	
Hondo	.....	.....	.....	0.70	
Houston	.....	33	.....	5.72	
Jacksonville	73	27	49.6	1.75	
Jasper	76	31	55.0	5.19	
Kaufman	77	26	49.4	.....	
Kent	.....	.....	.....	0.10	
Kerrville	79	24	48.8	0.40	
Kopperl	.....	.....	.....	0.60	
Lampasas	79	24	50.0	0.94	
Laureles Ranch	.....	.....	.....	1.15	
Llano[*5]	76	27	49.8	1.37	
Longview	74	25	48.6	2.01	
Luling	75	31	51.2	0.94	
Mann	74	26	48.4	1.27	
Menardville	73	20	47.3	0.97	
Nacogdoches	75	27	48.8	1.67	
Panter	.....	.....	.....	0.83	
Paris[a]	78	21	47.4	0.25	
Point Isabel[*1]	80	46	64.0	1.70	
Rockisland	76	33	54.0	2.03	
Rockport[*1]	74	40	62.3	.....	
Saginaw[*1]	74	20	47.6	0.30	
Sanderson	68	16	45.6	T.	
Sherman	71	22	49.4	0.42	
Sugarland	74	32	54.4	3.40	
Temple[a]	75	23	48.8	1.72	
Temple[b]	74	26	48.4	1.51	
Trinity	75	29	51.4	2.28	
Victoria	.....	.....	.....	1.45	
Waco	78	26	51.1	1.24	
Waxahachie	74	22	48.2	0.90	
Weatherford	72	17	48.8	0.33	
Wichita Falls	.....	.....	.....	T.	
Utah.					
Alpine	.....	.....	.....	0.70	7.0
Blackrock	54	− 4	30.3	0.01	T.
Bluecreek[*1]	50	0	31.4	0.10	1.0
Castledale	58	4	29.6	0.00	
Cisco	54	5	27.4	0.00	
Corinne	56	4	32.9	0.03	T.
Deseret	57	.....	.....	0.00	
Farmington	51	3	32.8	0.33	3.3
Fillmore	65	− 2	32.6	0.03	.....
Fishsprings	60	10	34.6	0.23	2.0
Fort Duchesne	48	−13	24.1	0.30	3.0
Frisco	53	− 2	34.8	0.05	0.5
Giles	53	− 4	27.4	0.00	
Government Creek	52	− 5	31.0	0.01	0.1
Green River	52	2	27.4	0.00	
Grover	59	− 2	32.0	0.00	
Heber	50	−10	28.2	0.22	1.0
Henefer	50	−27	24.8	0.43	2.8
Hite	64	14	38.4	.....	.....
Holyoake	59	8	35.4	T.	T.
Huntsville	.....	.....	.....	0.48	2.0
Kelton[*1]	50	− 3	33.8	0.30	T.
Levan	56	− 7	29.8	0.19	1.5
Loa	54	−20	22.0	T.	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins*
Logan	49	− 1	31.0	0.23	T.
Manti	58	− 6	31.1	0.00	
Millville	.....	.....	.....	0.13	.....
Minersville	54[b]	0	31.2[d]	0.05	0.5
Moab	55	7	33.0	0.00	
Mount Pleasant	53	− 5	31.0	T	T.
Ogden[*1]	52	7	33.9	0.18	1.0
Park City	47	− 6	27.3	1.30	12.5
Parowan	54	− 6	30.6	0.07	0.7
Pinto	68	−10	30.0	0.05	0.3
Promontory[*1]	48	0	30.4	0.17	0.5
Provo	55	− 6	33.2	0.12	0.5
Richfield	.....	0	.....	0.00	
St. George	66	5	37.3	0.00	
Scipio	57	− 6	28.4	0.10	1.0
Smithfield	.....	.....	.....	0.05	0.5
Snowville	50	1	30.4	0.10	1.0
Terrace[*1]	52	0	28.2	.....	.....
Thistle	60	−20	32.6	0.30	3.0
Tooele	53	6	32.3	0.01	T.
Tropic	57	1	30.2	0.00	
Vernal	50	− 7	27.6	0.04	0.4
Woodruff	51	−27	21.0	.....	.....
Vermont.					
Bennington	50	− 6	25.1	2.05	4.9
Burlington	44	− 4	24.8	1.42	11.0
Chelsea	46	−12	19.4	1.35	12.0
Cornwall	44	− 8	23.6	1.28	5.0
Derby	41	−18	18.4	1.40	12.2
Enosburg Falls	43	−19	18.4	4.24	33.0
Hartland	47	−14	19.9	2.06	6.5
Jacksonville	49	−15	19.6	2.42	21.0
Manchester	49	− 6	23.4	2.10	4.8
Norwich	47	−15	19.3	2.26	11.0
St. Johnsbury	40	−30	16.0	0.99	14.5
Vernon[*5]	47	− 5	24.0	1.97	9.0
Wells	44	−10	22.6	1.94	8.8
Woodstock	52	−21	17.4	2.25	.....
Virginia.					
Alexandria	59	15	36.8	2.65	0.6
Ashland	72	9	38.0	2.83	6.5
Barboursville	73	13	38.5	2.80	2.0
Bedford	61	17	39.9	4.25	3.0
Bigstone Gap	59	17	38.1	2.43	0.2
Birdsnest[*1]	58	22	38.0	2.40	T.
Blacksburg	56	13	37.4	3.37	3.5
Bon Air	63	16	38.3	3.00	4.5
Buckingham	67	10	36.3	3.03	4.5
Burkes Garden	53	12	33.8	2.70	T.
Callaville	65	15	38.4	2.60	
Charlottesville	63	15	39.2	4.16	2.0
Christiansburg	.....	.....	.....	3.20	2.5
Cliftonforge	.....	.....	.....	0.80	4.0
Columbia	.....	.....	.....	1.90	2.0
Dale Enterprise	62	8	34.8	1.61	3.9
Farmville	61	12	37.0	4.00	7.0
Fontella	65	15	41.8	3.62	2.0
Fredericksburg	60	15	36.6	3.43	3.0
Hampton	67	21	44.0	2.45	T.
Hot Springs	53	12	33.4	2.70	3.0
Lexington	64	14	38.0	2.21	2.0
Lincoln	57	12	34.6	.....	.....
Manassas	58	11	36.0	1.80	
Marion	66[g]	14[g]	37.6[g]	2.27	T.
Meadowdale	.....	11	.....	2.24	5.8
Newport News	67	21	43.0	2.05	
Petersburg	69	16	40.4	2.88	3.1
Quantico	59	9	34.1	.....	.....
Radford	.....	.....	.....	2.42	2.0
Rockymount	57	17	37.2	3.10[b]	3.0
Speers Ferry	.....	.....	.....	2.72	1.0
Spottsville	70	12	40.6	2.71	1.0
Staunton	63	15	38.3	2.05	1.0
Stephens City	61	10	34.9	1.98	1.5
Warsaw	62	13	37.9	1.96	2.0
Westpoint	69	14	37.2	2.65	5.0
Williamsburg	68	15	40.7	2.75	T.
Woodstock	56	12	34.5	1.30	2.0
Wytheville	61	19	37.6	1.91	0.5
Washington.					
Aberdeen	55	22	44 2	21.64	
Anacortes	.....	.....	.....	2.90	
Ashford	.....	.....	.....	12.03	1.0
Bremerton	58	26	45.0	11.04	
Brinnon	60	28	43.2	20.92	
Cedonia	47	4	32.0	3.49	5.5
Centerville	59	17	36.7	2.43	T.
Cheney	.....	.....	.....	2.81	2.0
Clearwater	55[j]	28	43.7[c]	20.87	
Cle Elum	58	5	35.6	4.10	2.0
Colfax	60	9	38.5	3.62	1.1
Colville	55	5	35.9	3.24	1.2
Conconully	49	8	32.8	4.57	2.1
Connell	.....	.....	.....	0.42	T.
Coupeville	55	26	44.6	3.67	T.
Crescent	50	6	34.4	2.94	2.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dayton	63	8	39.2	1.78	
Ellensburg	59	10	35.6	1.14	
Ellensburg (near)	56	8	35.2	1.08	T.
Grandmound	58	23	43.7	11.04	
Granite Falls				8.39	T.
Hooper	60	16	39.8	1.70	
Issaquah				8.66	
Lacenter	62	24	44.2	9.39	
Lakeside	57	20	39.0	2.63	T.
Lind	56	11	36.2	1.78	T.
Mayfield	51[d]	23[d]	40.2[d]	7.55	
Mottinger Ranch	64	24	43.8	0.89	T.
Mount Pleasant	59	22	43.8	7.64	
Moxee Valley	60	11	37.8	0.87	T.
New Whatcom	62	21	45.6	4.40	
Northport	47	— 7	33.8	3.79	4.0
Olga	58	29	43.6	4.52	
Olympia	59	23	45.2	10.03	
Pasco	62	22	42.2	0.65	T.
Pinehill	57	20	40.6	3.49	T.
Port Townsend	56	28	45.0	4.97	
Republic	47	— 1	32.8	2.95	3.0
Ritzville				0.73	T.
Rosalia	58	11	36.8	3.18	1.5
Sedro	67	18	43.8	3.15	0.3
Shoalwater Bay[*10]	57	30	47.1		
Snohomish	57	28	42.8	9.06	3.0
Snoqualmie				11.54	
Southbend	63	27	46.7	16.89	
Sprague				1.19	
Sunnyside	59	12	39.6	0.40	T.
Twin	54	28	43.4	16.83	
Union	60	25	43.6	17.24	
Usk	45	4	32.6		
Vancouver	59[c]	24	44.1	7.10	
Vashon	59	25	44.2	8.64	
Waterville	47	8	33.2	2.02	0.3
Wenatchee (near)	46	11	33.0	1.95	3.0
Westsound	56	21	44.6	4.36	2.2
West Virginia.					
Beckley	57	12	35.5	1.22	0.5
Beverly	58	7	32.6	2.89	3.0
Bluefield	55	16	36.9	2.04	0.5
Buckhannon	62	10	32.8	3.09	3.0
Burlington	56	7	33.0	1.85	1.0
Byrne	70	12	39.8	3.87	1.0
Central	60	9	33.4	1.76	0.2
Chapel	53	14	33.5		
Charleston				3.02	
Creston	66	11	34.0	1.98	T.
Dayton	61	10	32.1	1.70	T.
Eastbank	58	19	34.2	3.45	
Elkhorn	59	19	38.9	1.89	1.1
Fairmont				2.34	0.5
Glenville	61	11	34.8	2.81	T.
Grafton	62	9	33.1	2.55	T.
Green Sulphur	58	14	34.8	2.25	
Harpers Ferry				2.32	T.
Hinton *a*				1.71	T.
Hinton *b*	60	18	36.6		
Huntington	61	17	33.4	2.96	0.2
Josiah	58	10	33.4	1.91	T.
Lewisburg	57	15	34.4	2.34	T.
Magnolia	62	6	34.1	1.85	
Marlinton	52	10	30.6	2.99	2.5
Martinsburg	57	10	33.2	1.75	T.
Morgantown	63	10	34.2	1.54	T.
New Martinsville	63	12	35.1	1.82	0.5
Nuttallburg	60	12	36.3	2.86	0.5
Oceana	60	16	36.5	2.44	
Parsons	58	6	31.2	3.00	
Philippi *a*	62	6	31.8	3.23	7.0
Point Pleasant	60	15	38.0	1.99	T.
Powellton	59	18	36.6	3.01	T.
Princeton	54	14	35.6	3.23	3.0
Romney	59	8	33.8	1.77	1.8
Rowlesburg				1.32	
Southside	60	20	37.2	2.17	1.0
Spencer	58	10	34.8	2.51	1.0
Terra Alta	58	3	31.4		
Uppertract	58	9	36.1	1.82	
Wellsburg	56	6	31.5	1.44	1.0
Weston *a*				2.88	1.0
Weston *b*	66	10	35.4		
Wheeling *a*				1.56	0.4
Wheeling *b*	60	14	37.4	1.55	T.
Williamson	65	18	39.8	2.03	0.1
Winfield	61	17	36.6	3.01	T.
Wisconsin.					
Amherst	44	0	21.8	1.35	2.5
Ashland				0.84	6.1
Barron	50	—16	17.5	1.05	9.5
Bayfield	38	— 8	21.0		
Beloit	48	1	27.8	0.73	5.0
Brodhead	52	4	27.0	0.73	5.0
Butternut	40	—17	17.0	1.17	8.5
Wisconsin—Cont'd.					
Citypoint	44	—17	23.0	0.34	3.4
Delavan	49	0	27.7	0.07	0.3
Dodgeville	49	— 2	24.7	1.00	7.5
Easton	47	— 7	23.4	0.68	4.2
Eau Claire	44	—10	21.8	1.00	10.5
Florence	39	— 8	20.5	0.40	T.
Fond du Lac	45	0	25.2	0.50	5.4
Grand River Locks				0.53	2.5
Grantsburg	47	—21	20.6	0.75	7.5
Hartford	49	3	26.7	0.77	4.5
Hartland	47	2	26.3	0.44	4.0
Harvey	46	6	25.8	0.73	4.6
Hayward	43	—30	20.0	0.92	9.2
Heafford	39	— 8	18.6	0.65	4.0
Hillsboro	47	—12	23.6	0.70	5.0
Koepenick				0.95	5.0
Lancaster		— 7		0.33	3.0
Madison	47	— 4	26.1	0.47	3.3
Manitowoc	44	3	26.7	1.06	14.8
Meadow Valley	45	— 7	21.4	0.40	7.5
Medford	49	—12	18.1	0.75	4.0
Menasha				0.48	3.8
Neillsville	42	— 7	21.5	0.93	2.0
New Holstein	49	5	25.8	0.32	3.2
New London	44	1	23.0	0.77	1.2
Oconto	45	3	26.0	1.03	4.5
Osceola	45	—16	18.2	0.67	2.0
Pepin	44	—14	21.9	0.85	4.0
Pine River	43	— 1	23.6	0.84	4.9
Portage	46	1	25.0	0.45	7.0
Port Washington	51	—14	26.9	0.70	6.0
Prairie du Chien *a*	53	1	27.7	0.35	1.8
Prairie du Chien *b*				0.15	2.0
Racine	48	8	29.8	0.34	
Shawano	44	0	22.6	0.83	2.0
Sheboygan	46	8	28.5	0.89	4.5
Spooner	42	—14	19.0	0.90	9.0
Stevens Point	42	1[c]	22.2	0.45	4.5
Sturgeon Bay Canal[*9]	41	5	25.0		
Viroqua	46	— 5	23.7	0.72	4.0
Watertown	48	5	24.6	0.73	5.0
Waukesha	46	— 2	25.6	0.45	4.4
Waupaca	42	1	23.4	1.01	3.8
Wausaukee	45	—13	22.6	0.35	3.0
Westbend	48	10	24.0		
Westfield	43	4	24.6	1.13	6.5
Whitehall	46	—10	18.4	1.10	6.0
Wyoming.					
Alcova	55	—13	32.4	0.63	9.0
Basin	51	—18	26.6	T.	T.
Bedford	46	—28	20.6	0.67	6.2
Bitter Creek	60	—33	27.8	0.30	3.0
Buffalo	59	—13	30.0	0.26	1.3
Burlington	64	—15	28.4	0.30	T.
Casper	58	— 7	34.4	0.81	9.5
Centennial	48	—27	24.8	0.46	5.5
Chugwater	59	—10	31.4	1.12	8.7
Cody	60	— 8	36.7	T.	T.
Daniel	65	—25	25.1	0.30	2.0
Evanston	43	—19	21.8	0.35	3.5
Fort Laramie	65	—10	31.1	0.70	11.5
Fort Washakie	68	—34	27.8	1.10	11.0
Fort Yellowstone	44	—25	24.4	1.18	11.8
Fourbear	58	—21	29.7	0.30	7.0
Griggs	63	—31	33.5	0.54	6.2
Hyattville	56	—18	31.2	0.00	
Iron Mountain	53	—21	30.6	0.08	0.8
Laramie	49	—27	25.6	0.03	0.3
Lovell [b]	53	— 2	27.2		
Lusk	59	—22	29.0		
Parkman	64	—10	34.0	0.58	16.5
Pinebluff	63	—21	31.2	T.	T.
Rawlins	45	—24	25.2	0.30	3.0
Saratoga	55	—24	27.2	0.75	7.5
Sheridan	61	—13	31.6	0.76	1.0
South Pass City	47	—17	21.6	0.23	2.3
Wheatland		—12		0.20	2.0
Cuba.					
Aguacate	89	57	73.8	1.25	
Alvarez				1.89	
Australia	88	52	72.6	2.85	
Banaguises	89	53	72.1	1.32	
Batabano	81	58	71.2	0.22	
Cruces				1.28	
Gibara	89	61	74.8	2.39	
Guabairo				0.88	
Guanajay	83	58	71.4	2.27	
Guantanamo	92	58	76.0	0.59	
Holguin	87	63	75.2	1.53	
Limonar	90			0.80	
Los Canos	94	58	75.7	1.04	
Magdalena				0.64	
Manzanillo	94	66	78.4	0.15	
Matanzas	87	57	72.4	1.12	
Moron Trocha	89	57	74.6	0.77	
Nuevitas	90	67	77.0	2.25	
Cuba—Cont'd.					
Numero	85	59	72.0	3.20	
Pinar del Rio	85	59	73.4	1.00	
Romelie				0.96	
Sagua la Grande	89	58	74.6	2.25	
San Cayetano	90	59	74.4	1.60	
Santa Clara	89	53	73.6	3.38	
Sancti Spiritus	87	67	76.7	2.34	
Soledad	87	59	73.6	0.46	
Union de Reyes	88	63	75.0	0.00	
Yaguajay	91	60	74.3	1.96	
Porto Rico.					
Adjuntas	88	67	79.1	1.54	
Aguadilla	87	61	74.4	2.55	
Arecibo	87	62	74.9	5.89	
Bayamon	94	59	76.4	6.70	
Canovanas	86	67	76.2	4.09	
Cayey	94	56	76.0	2.38	
Cidra	90	56	72.2	3.25	
Coamo	92	60	76.9	0.12	
Corozal	89	56	72.9	3.10	
Fajardo	89	64	78.2	3.44	
Hacienda Coloso	92	57	75.8	2.29	
Hacienda Perla	89	63	76.6	6.57	
Humacao		62[c]		4.74	
Isabela	87	65	76.8	3.50	
Juana Diaz	93	63	78.6	0.50	
La Isolina	89	61	74.4	2.34	
Lajas	90	56	74.4	4.22	
Manati	92	62	76.2	4.39	
Maunabo	87	72	79.4	3.85	
Mayaguez	92	61	78.1	4.20	
Puerta de Tierra	88	70	78.3	2.71	
San Lorenzo	92	57	74.9	5.33	
Utuado	88	56	74.3	1.08	
Vieques	86	66	75.8	2.65	
Yanco	91	58	76.0	2.74	
Mexico.					
Ciudad P. Diaz	75	33	53.0	0.22	
Coatzacoalcos	86	51	70.3	17.09	
Leon de Aldamas	72	39	56.0	2.08	
Puebla	70	43	56.8	3.53	
Tampico	79	52	64.8	3.44	
Topolobampo[*1]	85	35	60.5		
Vera Cruz	84	60	72.0	0.45	
New Brunswick.					
St. John	44	— 4	22.6	2.95	24.8

Late reports for November, 1900.

Alaska.					
Coal Harbor	56	18	36.6	7.68	17.0
Fort Liscum	50	0	22.4	2.85	44.0
Kenai	34	—26	13.4	0.90	14.5
Killisnoo	45	10	31.8	7.05	7.5
Orca	47	14	28.6	4.72	40.0
Sitka	51	15	36.4	9.39	0.5
Arizona.					
Ingleside	90[c]	39[c]	61.9[c]	1.77	
Mohawk Summit[*1]	90	53	71.3	T.	
Russellville				1.55	
San Simon[*5]	72	37	55.0	0.20	
California.					
Coronado				1.22	
Folsom[*1]	76	36	55.5	3.99	
Fort Tejon				1.71	
Kernville				5.00	
Manzana	80	31	57.4	2.55	
West Point				11.07	
Yuba City[*5]	80	40	58.2	4.27	
Georgia.					
Diamond	71	22	50.1	5.53	
Illinois.					
Danville				3.56	T.
Kentucky.					
Pikeville	80	23	50.5	9.61	
Maryland.					
Chase	73	22	46.2	1.15	
Michigan.					
Annpere	73	15	40.6	3.02	6.0
Ionia	74	14	40.8	2.57	7.0
Montana.					
Chester		—33		0.39	1.5
Nebraska.					
Albion	80	— 2	36.4		
Johnstown				0.10	1.0
Kennedy[d]	67	4	34.4	0.20	2.0
North Carolina.					
Morganton	79	24	50.9	2.26	
Tarboro	86	27	55.6	3.70	
North Dakota.					
Larimore	57	—14	19.4	1.00	
Washington.					
Mount Pleasant	62	15	44.8	6.35	0.8

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin.	°	°	°	*Ins.*	*Ins.*
Citypoint	65	0	27.3	1.09	.....
Wyoming.					
Wheatland	.....	.....	.....	0.40	.....
Cuba.					
Santa Cruz	88	69	78.5	.....	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

April, 1900, North Carolina, Horse Cove, make precipitation 9.06 instead of 8.86.

TABLE III.—*Mean temperature for each hour of seventy-fifth meridian time, December, 1900.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N Dak....	19.3	19.1	19.3	18.6	18.4	17.8	17.5	17.8	16.8	17.4	19.0	21.6	24.0	25.6	26.5	25.9	25.9	24.1	22.1	21.2	19.8	19.3	18.7	18.4	20.6
Boston, Mass	31.4	30.9	30.5	30.4	29.8	29.7	29.8	30.6	31.5	32.8	34.8	36.2	37.6	38.5	38.6	37.9	37.1	36.2	35.3	34.7	34.0	33.4	32.7	32.3	33.6
Buffalo, N. Y.....	30.6	30.6	30.7	30.2	30.4	30.4	30.5	30.4	30.5	31.0	31.6	32.3	33.1	33.3	33.4	33.0	32.5	32.0	31.7	32.0	31.5	31.0	30.6	30.5	31.4
Cedar City, Utah*..	34.1	33.8	33.3	32.4	32.3	31.7	30.5	29.8	28.6	28.2	29.1	33.0	36.2	39.8	42.4	44.0	45.6	46.2	45.2	40.2	39.1	37.6	36.2	34.8	36.0
Chicago, Ill.....	29.2	28.6	28.4	28.0	27.6	27.3	27.3	27.5	27.5	27.7	29.2	30.5	31.6	32.5	33.1	33.2	32.8	32.1	31.6	31.0	30.2	29.6	29.1	28.6	29.8
Cincinnati, Ohio....	34.0	33.5	32.8	32.0	31.7	31.5	31.5	32.2	32.1	33 4	35.4	37.4	39.0	40.0	40.8	41.1	40.3	39.5	33.6	37.6	36.5	35.8	35.0	34.5	35.7
Cleveland, Ohio	30.7	30.7	30.5	30.5	30.4	30.1	30.0	29.9	30.0	30.8	31.9	33.1	34.0	34.4	34.8	34.7	34.3	33.5	33.0	32.6	31.9	31.5	31.1	30.6	31.9
Detroit, Mich.....	28.8	28.7	28.3	28.0	27.7	27.4	27.2	27.4	27.2	28.0	29.2	30.2	31.1	31.9	32.6	32.5	31.8	31.2	30.3	29.6	29.3	28.9	28.7	28.4	29.4
Dodge, Kans.....	30.2	29.4	28.9	28.1	26.7	25.7	24.5	24.5	24.2	26.9	32.6	38.1	42.6	45.3	47.6	48.9	49.0	46.9	41.2	37.1	34.3	32.5	30.8	29.9	34.4
Eastport, Me.....	23.4	22.7	22 5	22.6	22.5	22.7	22.8	23.1	23.7	24.5	25.5	26.3	26.5	26.7	26.6	26.5	26.1	26.0	25.6	25.6	25.2	25.0	24.6	24.3	24.6
Galveston, Tex.....	56.0	55.7	55.5	55.1	54.6	54.4	54.2	54.1	54.0	54.6	55.7	56.9	57.8	58.5	59.5	60.0	59.6	58.5	57.5	57.1	56.8	56.5	56.3	56.1	56.4
Havre, Mont.....	31.5	31.0	29.9	30.2	29.7	29.4	28.5	28.6	27.4	26.7	28.2	31.0	33.1	35.3	36.8	37.7	38.0	36.1	33.6	32.4	30.9	30.6	30.4	30.3	31.5
Independence, Cal..	42.1	41.2	40.0	38.8	38.5	37.7	37.3	37.2	35.3	34.8	35.7	37.7	41.5	45.1	48.8	51.2	53.0	53.4	51.9	49.2	46.2	44.6	43.6	42.0	42.8
Kalispell, Mont	30.8	30.5	30.3	29.8	29.4	29.0	28.6	28.5	28.4	28.5	28.9	29.5	30.5	31.7	33.1	34.0	35.0	34.3	32.9	32.1	31.4	31.0	30.5	30.3	30.8
Kansas City, Mo.....	34.9	34.2	33.6	32.9	32.2	31.5	31.2	31.2	30.6	31.3	33.0	35.5	37.4	39.0	40.7	41.4	40.8	40.0	39.0	37.7	37.0	36.1	35.4	34.7	35.5
Key West, Fla.....	70.0	69.9	69.5	69.4	69.3	69.2	69.1	69.7	70.5	71.5	72.1	72.9	73.4	73.3	73.0	72.8	72.5	71.9	71.4	71.2	70.9	70.7	70.5	70.3	71.0
Marquette, Mich	24.3	23.9	23.6	23.5	23.3	23.2	23.0	23.1	23.0	23.4	24.0	24.5	25.5	25.8	25.8	25.7	25.4	25.1	24.6	24.8	24.3	24.0	23.8	23.4	24.2
Memphis, Tenn.....	45.4	44.3	43.5	42.6	42.2	41.6	41.4	41.0	41.4	42.0	44.4	46.8	49.1	50.7	51.6	52.3	51.9	50.9	49.5	48.7	47.5	46.9	46.3	45.6	46.2
Mt. Tamalpais, Cal..	49.2	49.0	48.6	48.5	47.9	47.5	47.6	47.6	47.4	46.9	47.2	47.5	48.2	48.8	49.3	49.3	49.9	49.6	48.9	48.6	49.0	49.6	49.2	48.8	48.5
New Orleans, La.....	53.0	52.3	52.1	51.7	51.5	50.9	50.7	50.9	52.3	54.6	56.8	58.3	60.0	60.5	60.7	60.5	59.7	58.2	57.5	56.8	55.5	54.6	53.9	53.7	55.3
New York, N. Y.....	33.6	33.4	32.8	32.2	32.0	32.0	31.7	31.8	32.0	33.0	34.6	36.4	37.8	38.6	39.3	39.1	38.7	37.7	37.0	36.7	35.7	35.1	34.6	34.1	35.0
Philadelphia, Pa.....	34.1	33.6	33.2	32.7	32.4	32.1	32.4	33.3	34.6	36.1	38.0	39.6	40.7	41.3	41.5	40.9	40.0	39.4	38.5	37.8	36.9	36.3	35.4	34.5	36.5
Pittsburg, Pa.....	33.0	32.6	32.2	32.0	31.6	31.7	31.6	32.0	32.4	33.4	34.6	35.5	36.4	37.7	38.4	38.4	38.0	37.2	36.3	36.0	35.2	35.0	34.4	33.8	34.6
Portland, Oreg.....	44.6	44.2	43.3	42.8	42.8	43.0	42.7	42.7	42.2	42.0	41.8	42.0	43.5	44.0	44.5	45.7	47.0	47.4	47.2	46.8	45.7	45.0	44.5	44.5	44.2
St. Louis, Mo.....	37.2	36.4	35.6	35.1	34.5	33.7	33.2	33.1	33.1	33.7	35.3	36.9	38.5	39.9	41.1	41.8	41.7	41.1	40.2	39.8	38.9	38.2	37.5	37.2	37.2
St. Paul, Minn.....	21.4	21.1	20.7	20.7	20.5	20.3	20.0	19.9	19.8	19.7	20.3	21.3	22.7	23.6	24.2	24.8	24.6	24.3	23.5	22.7	22.2	21.5	21.0	20.8	21.7
Salt Lake City, Utah.	33.8	32.9	33.0	32.4	32.1	31.6	31.4	31.6	31.4	30.1	30.7	32.8	35.5	37.0	38.5	39.1	39.6	39.0	37.3	36.5	34.9	34.4	33.4	33.0	34.3
San Diego, Cal.....	57.3	56.9	56.2	56.0	55.1	54.7	54.4	54.4	54.4	53.9	55.0	58.7	63.2	65.5	67.0	67.2	66.6	66.8	65.7	63.7	61.9	60.3	59.0	58.1	59.7
San Francisco, Cal..	49.5	48.8	48.2	47.5	47.1	46.9	47.1	48.4	47.2	46.9	47.1	48.3	49.4	50.5	52.0	52.9	53.6	54.0	53.3	52.8	52.5	51.6	50.8	50.0	48.8
Santa Fe, N. Mex ...	28.4	27.7	27.1	26.3	25.9	25.2	24.1	24.9	23.8	25.6	30.2	32.7	35.3	36.9	39.0	40.7	41.3	40.1	36.0	32.3	30.0	29.3	28.9	28.8	30.9
Savannah, Ga.....	49.5	48.9	48.3	47.9	47.6	47.1	46.9	46.6	47.7	50.7	53.6	55.7	57.0	58.3	58.8	58.7	57.5	55.4	54.2	53.3	52.1	51.5	50.6	50.3	52.0
Washington, D. C....	32.9	32.5	32.4	32.0	31.4	31.2	31.0	31.4	33.4	36.1	38.7	40.8	42.2	43.3	43.5	43.5	42.2	40.4	38.7	37.3	35.8	35.3	34.5	33.8	36.4
West Indies.																									
Basseterre, St. Kitts.	76.3	75.9	75.9	75.8	76.1	76.2	78.7	80.1	81.3	81.5	81.9	81.7	81.7	81.1	80.4	79.5	78.2	77.5	77.3	77.6	77.5	77.2	77.2	76.7	78.5
Bridgetown, Bar.....	75.5	75.2	75.0	74.9	74.6	76.3	80.3	81.8	83.1	84.1	84.3	84.5	84.1	83.4	82.3	80.9	78.7	77.9	77.3	77.1	76.7	76.4	76.2	75.8	79.0
Cienfuegos, Cuba †..	69.7	69.0	68.5	68.2	68.0	68.0	67.9	70.8	74.6	77.6	79.6	80.9	82.2	81.4	80.7	80.0	78.1	76.4	74.7	73.6	72.8	72.0	71.2	70.5	74.0
Havana, Cuba.....	71.1	70.7	70.2	69.9	69.7	69.7	69.8	70.5	73.1	75.5	77.4	78.2	78.4	78.6	78.0	77.2	76.2	75.0	74.2	73.6	73.2	72.6	72.2	71.5	73.6
Kingston, Jamaica..	71.4	70.8	70.7	70.4	70.2	70.2	70.1	74.4	79.4	82.0	84.0	84.7	84.5	84.5	83.6	82.5	80.9	78.3	76.4	75.4	73.8	73.0	72.5	71.7	76.5
Port of Spain, Trin..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
P. Principe, Cuba ...	69.0	68.2	67.7	67.2	67.0	66.8	66 8	69.4	72.8	76.1	78.7	81.0	82.1	82.7	82.7	81.1	79.5	76.7	74.3	72.4	71.6	70.9	70.2	69.6	73.5
Roseau, Dominica ..	74.6	74.3	74.3	74.0	73.9	74.1	77.4	80.1	82.6	83.4	84.2	83.9	83.7	83.5	82.6	81.3	78.2	76.9	76.1	75.9	75.5	75.2	74.7	74.7	78.1
San Juan, P. R.....	73.6	73.4	73.1	72.9	72.7	73.1	74.6	76.5	79.9	81.1	81.6	82.0	82.2	81.5	80.5	79.3	78.2	77.6	76.9	76.5	75.5	74.9	74.5	74.0	76.9
Santiago de Cuba...	72.2	71.7	71.0	70.7	70.5	70.3	71.3	73.6	79.0	82.1	84.6	85.4	85.7	85.3	84.2	82.8	80.9	79.1	77.6	76.5	75.5	74.6	73.8	73.2	77.2
Santo Domingo, S. D.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Willemstad, Curaçao	77.9	77.3	77.1	77.1	77.1	77.0	78.9	80.7	81.4	82.5	82.6	83.2	83.2	82.8	82.2	81.7	79.9	79.1	78.8	78.7	78.5	78.5	78.3	78.2	79.7

* For 20 days. † For 27 days.

TABLE IV.—*Mean pressure for each hour of seventy-fifth meridian time, December, 1900.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N. Dak....	28.244	.239	.234	.233	.231	.227	.226	.229	.234	.236	.239	.245	.240	.230	.223	.223	.229	.236	.240	.243	.247	.249	.250	.252	.237
Boston, Mass.....	29.877	.880	.881	.874	.880	.886	.897	.902	.912	.918	.904	.884	.870	.868	.867	.868	.874	.879	.885	.882	.880	.878	.878	.875	.883
Buffalo, N. Y.....	29.187	.186	.189	.186	.181	.183	.190	.196	.203	.210	.204	.193	.177	.171	.170	.173	.180	.185	.190	.191	.190	.191	.192	.192	.188
Cedar City, Utah*...	24.454	.432	.448	.443	.444	.439	.438	.436	.448	.455	.463	.474	.472	.454	.432	.418	.410	.412	.412	.414	.420	.426	.432	.438	.439
Chicago, Ill.....	29.155	.150	.156	.155	.151	.151	.154	.162	.163	.172	.179	.170	.158	.144	.137	.138	.146	.153	.159	.168	.166	.166	.168	.167	.158
Cincinnati, Ohio	29.432	.429	.430	.431	.427	.427	.435	.440	.448	.456	.464	.455	.433	.423	.416	.418	.426	.431	.442	.445	.448	.447	.448	.447	.437
Cleveland, Ohio	29.231	.234	.236	.234	.231	.236	.242	.245	.248	.255	.248	.235	.221	.213	.216	.218	.224	.232	.238	.243	.243	.243	.244	.238	.235
Detroit, Mich.....	29.249	.248	.250	.251	.245	.249	.255	.256	.260	.265	.269	.256	.240	.228	.224	.228	.233	.242	.249	.257	.261	.261	.258	.261	.250
Dodge, Kans	27.475	.475	.471	.474	.473	.468	.466	.463	.465	.465	.476	.478	.462	.440	.421	.411	.414	.420	.427	.448	.459	.464	.469	.476	.457
Eastport, Me	29.875	.874	.871	.866	.864	.866	.874	.880	.887	.893	.883	.873	.860	.857	.857	.859	.867	.876	.882	.885	.885	.881	.878	.870	.874
Galveston, Tex.....	30.060	.054	.052	.050	.051	.047	.054	.065	.073	.085	.094	.089	.070	.039	.022	015	.013	.015	.027	.036	.045	.051	.056	059	.051
Havre, Mont.....	27.336	.335	.334	.338	.341	.340	.337	337	.339	.341	.345	.352	.352	.343	.334	.325	.323	.329	.334	.349	.341	.341	.342	.342	338
Independence, Cal..	26.155	.158	.159	.155	.158	.155	.150	.144	.158	.162	.167	.179	.185	.173	.147	.125	.111	.102	.098	.096	.107	.118	.131	.139	.143
Kalispell, Mont	27.003	.004	.004	.004	.009	.005	.005	.007	.011	.014	.019	.029	.034	.024	.011	.001	.995	.997	.002	.000	.001	.001	.003	.004	.008
Kansas City, Mo.....	29.075	.074	.076	.080	.078	.075	.074	.083	.090	.101	.106	.106	.090	.067	.051	.043	.046	.052	.059	.063	.068	.075	.078	.083	.075
Key West, Fla.....	30.045	.041	.035	.029	.030	.037	.050	.066	.075	.087	.081	.067	.041	.022	.014	.010	.013	.018	.029	.044	.052	.058	.057	.054	.044
Marquette, Mich ...	29.168	.169	.176	.172	.168	.163	.166	.162	.160	.168	.168	.165	.147	.142	.136	.141	.147	.153	.156	.161	.163	.166	.172	.174	.161
Memphis, Tenn.....	29.697	.694	.701	.705	.706	.705	.707	.723	.732	.742	.748	.745	.730	.701	.686	.681	.682	.681	.685	.693	.700	.699	.704	.707	.706
Mt. Tamalpais, Cal .	27.689	.693	.687	.683	.687	.684	.677	.666	.661	.667	.683	.693	.704	.703	.688	.674	.668	.667	.666	.668	.671	.677	.680	.679	.680
New Orleans, La.....	30.063	.061	.065	.063	.062	.064	.075	.085	.098	.105	.102	.092	.069	.044	.031	.029	.030	.035	.042	.046	.057	.062	.066	.068	.063
New York, N. Y.....	29.731	.734	.736	.731	.731	.738	.747	.755	.759	.761	.744	.724	.704	.694	.693	.691	.701	.710	.715	.718	.720	.724	.732	.731	.726
Philadelphia, Pa.....	29.980	.985	.983	.979	.981	.984	.992	.002	.005	.009	.993	.970	.955	.943	.939	.941	.944	.953	.964	.971	.976	.981	.985	.983	.975
Pittsburg, Pa.....	29.180	.177	.177	.172	.168	.169	.174	.176	.181	.188	.186	.173	.157	.147	.143	.148	.157	.167	.178	.183	.185	.186	.186	.184	.173
Portland, Oreg.....	29.953	.955	.956	.956	.959	.961	.952	.949	.945	.949	.948	.954	.961	.963	.955	.945	.937	.934	.939	.940	.942	.947	.948	.948	.950
St. Louis, Mo.....	29.472	.472	.478	.481	.479	.483	.491	.499	.509	.518	.525	.518	.496	.479	.467	.465	.465	.470	.476	.481	.483	.485	.484	.485	.486
St. Paul, Minn.....	29.121	.120	.117	.119	112	.106	.103	.108	.108	.113	.121	.127	.116	.108	.097	.097	.100	.108	.116	.121	.124	.122	.122	.121	.114
Salt Lake City, Utah.	25.797	.799	.795	.793	.795	.794	.788	.790	.794	.802	.809	.820	.825	.814	.793	.779	.773	.771	.769	.772	.782	.787	.788	.790	.793
San Diego, Cal.....	29.971	.972	.971	.966	.965	.961	.953	.952	.958	.968	.976	.991	.993	.982	.954	.941	.933	.925	.925	.929	.939	.950	.957	.963	.958
San Francisco, Cal...	30.032	.054	.049	.048	.047	.044	.038	.029	.034	.034	.045	.056	.070	.062	.048	.035	.025	.023	.023	.025	.029	.035	.039	.044	.041
Santa Fe, N. Mex ...	23.302	.299	.294	.295	.294	.289	.285	.283	.293	.297	.307	.316	.306	.285	.265	.256	.253	.254	.258	.266	.275	.283	.287	.293	.285
Savannah, Ga.....	30.056	.054	.051	.048	.046	.054	.066	.078	.089	.097	.095	.078	.053	.038	.032	.029	.029	.038	.048	.057	.061	.064	.068	.065	.058
Washington, D. C....	30.006	.005	.006	.005	.001	.000	.008	.017	.023	.029	.018	.994	.970	.958	.960	.965	.971	.980	.993	.999	.004	.009	.007	.007	.997
West Indies.																									
Basseterre, St. Kitts.	29.949	.937	.930	.933	.942	.959	.982	.001	.007	.001	.983	.962	.942	.931	.928	.934	.943	.953	.968	.983	.989	.985	.978	.972	.962
Bridgetown, Bar....	29.901	.889	.887	.890	.901	.916	.935	.951	.952	.946	.930	.909	.892	.878	.878	.882	.890	.901	.914	.928	.931	.916	.927	.920	.911
Cienfuegos, Cuba †..	29.952	.942	.934	.934	.939	.950	.966	.982	.997	.999	.988	.969	.941	.926	.918	.919	.927	.935	.951	.967	.979	.984	.978	.971	.956
Havana, Cuba.....	29.982	.975	.967	.963	.962	.969	.981	.997	.013	.023	.019	.001	.977	.955	.947	.945	.950	.959	.971	.987	.997	.001	.001	.995	.981
Kingston, Jamaica..	29.670	.653	.640	.638	.644	.653	.675	.692	.705	.702	.687	.663	.633	.610	.600	.600	.611	.626	.646	.665	.681	.688	.687	.682	.656
Port of Spain, Trin..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
P. Principe, Cuba ...	29.678	.669	.659	.655	.659	.670	.683	.695	.708	.716	.707	.691	.660	.642	.633	.631	.639	.651	.665	.679	.691	.699	.698	.694	674
Roseau, Dominica ..	29.924	.914	.913	.914	.925	.939	.956	.975	.980	.974	.955	.932	.915	.905	.903	.907	.915	.929	.941	.954	.959	.958	.955	.947	.937
San Juan, P. R.....	29.915	.904	.898	.902	.910	.923	.940	.955	.957	.952	.936	.916	.898	.887	.883	.891	.902	.914	.927	.941	.944	.943	.939	.934	.921
Santiago de Cuba...	29.896	.886	.875	.876	.883	.889	.903	.918	.931	.928	.915	.893	.860	.843	.841	.844	.853	.866	.887	.907	.918	.922	.917	.910	.890
Santo Domingo, S. D.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Willemstad, Curaçao	29.816	.805	.798	.805	.815	.831	.857	.873	.880	.871	.853	.827	.798	.779	.769	.771	.781	.795	.815	.834	.848	.850	.845	.839	.823

* For 20 days. † For 27 days.

TABLE V.—*Average wind movement for each hour of seventy-fifth meridian time, December, 1900.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	7.2	7.4	7.7	7.9	7.7	7.4	6.7	6.5	6.0	6.4	8.2	9.7	10.5	10.8	11.0	10.8	10.4	9.6	7.6	6.6	6.1	7.0	7.3	7.1	8.1
Albany, N. Y.	6.4	6.6	7.0	6.5	6.7	7.0	7.3	7.0	7.2	8.0	8.5	8.3	8.3	7.7	8.1	7.3	6.6	6.4	6.6	6.9	7.0	7.1	6.5	6.6	7.1
Alpena, Mich.	10.7	10.9	11.2	11.0	10.6	10.4	10.4	11.0	10.9	11.0	12.0	12.5	12.9	13.2	12.3	11.4	10.7	9.9	10.1	9.9	10.0	10.4	10.5	10.6	11.0
Amarillo, Tex.	14.0	13.0	12.4	12.0	13.1	12.9	12.7	12.9	13.1	13.1	13.0	14.7	15.7	16.0	16.6	16.4	15.3	15.1	12.4	12.4	12.4	12.6	13.2	14.1	13.7
Atlanta, Ga.	10.9	11.2	11.0	10.6	11.1	10.7	10.3	10.7	10.8	11.1	11.1	10.5	11.0	11.3	10.7	10.8	9.6	8.4	9.2	9.6	9.6	10.4	10.7	10.8	10.5
Atlantic City, N. J.	10.2	10.3	9.9	10.4	10.5	10.6	9.6	9.9	10.3	10.7	11.5	12.0	12.1	12.4	12.3	11.9	10.7	10.1	9.5	9.5	9.9	10.0	10.2	10.1	10.6
Augusta, Ga.	3.8	4.2	4.4	4.3	3.8	4.7	5.3	5.1	5.0	5.6	6.5	7.1	8.2	7.9	7.3	7.2	6.2	4.9	4.2	3.7	3.5	3.8	4.1	3.9	5.2
Baker City, Oreg.	5.0	5.5	5.5	5.8	6.1	5.5	5.2	5.1	5.1	5.8	5.7	5.3	5.7	5.5	6.4	6.6	5.6	6.1	4.8	4.7	5.0	5.1	5.1	5.3	5.5
Baltimore, Md.	3.3	3.7	4.0	4.0	3.8	3.7	4.1	4.7	4.9	5.1	6.5	6.1	6.5	6.4	6.4	6.2	5.6	4.8	4.4	4.0	3.8	4.0	3.5	3.7	4.6
Bismarck, N. Dak.	8.7	8.5	8.5	9.0	8.5	8.3	8.4	8.7	9.0	8.7	9.2	10.3	11.2	12.4	13.0	12.8	12.3	10.3	10.1	9.1	8.9	9.5	9.3	8.0	9.7
Block Island, R. I.	18.7	19.4	19.4	19.5	19.8	19.9	20.2	20.0	19.7	19.9	19.8	19.7	20.0	19.5	19.6	18.9	17.8	18.3	18.5	18.3	17.8	18.2	17.8	18.2	19.1
Boise, Idaho	3.6	3.8	3.9	3.9	3.7	3.8	4.1	3.9	3.7	4.5	4.6	4.6	5.2	5.1	5.1	4.8	5.2	5.1	4.8	4.2	3.5	3.5	3.7	3.5	4.2
Boston, Mass.	10.7	9.8	9.6	9.9	10.3	10.8	11.0	10.3	10.8	11.4	11.5	12.1	11.9	11.9	11.8	11.5	10.7	10.7	10.6	10.6	11.2	11.5	11.1	10.6	11.0
Buffalo, N. Y.	18.2	17.6	17.5	16.4	16.4	16.9	17.8	16.8	16.6	16.6	17.5	17.5	18.0	18.4	18.9	18.6	17.8	17.0	17.1	18.1	19.2	19.6	19.3	18.2	17.8
Cairo, Ill.	7.6	7.5	7.6	7.6	7.6	8.2	8.3	8.5	9.0	9.0	11.0	10.1	10.1	10.5	10.4	9.5	9.3	8.3	7.9	8.3	9.0	8.9	8.1	7.7	8.8
Cape Henry, Va.	13.4	13.3	13.1	14.0	14.1	13.4	14.0	14.1	14.5	14.1	13.0	13.2	13.2	12.3	11.7	11.4	10.4	10.8	11.6	12.0	12.6	13.5	13.5	12.6	12.9
Carson City, Nev.	3.9	3.5	3.5	4.3	4.0	3.9	4.2	4.5	4.9	5.5	5.2	5.2	5.3	6.0	6.8	7.7	7.6	7.2	7.3	6.3	6.0	5.0	4.8	4.4	5.3
Cedar City, Utah*	4.9	5.0	4.8	4.8	4.4	3.8	4.1	4.1	3.0	2.8	2.6	1.9	1.5	2.8	4.3	6.2	5.2	4.2	3.9	4.4	4.8	4.4	4.7	4.5	4.0
Charleston, S. C.	10.0	9.7	10.7	10.2	11.0	10.8	10.2	10.2	10.9	11.5	10.9	10.9	11.6	11.5	11.4	11.4	10.7	9.6	9.5	9.0	9.1	9.2	9.2	9.5	10.4
Charlotte, N. C.	5.8	5.6	6.1	6.0	5.3	5.8	5.3	4.9	4.9	5.3	6.4	6.8	7.2	7.8	7.7	7.5	6.1	5.5	5.3	5.6	5.6	5.8	5.5	5.5	6.0
Chattanooga, Tenn.	5.9	6.0	5.4	5.3	4.6	4.2	4.8	4.9	4.7	5.9	7.0	7.4	6.9	7.7	8.8	8.8	8.3	7.6	7.0	6.4	5.7	5.6	5.5	6.1	6.3
Cheyenne, Wyo.	11.3	12.8	13.5	13.8	13.4	12.1	10.7	12.0	12.4	11.6	13.8	15.7	18.5	19.0	19.5	18.6	18.1	14.3	13.2	10.6	9.5	10.7	11.9	11.5	13.6
Chicago, Ill.	16.9	15.9	16.2	16.1	16.0	15.8	15.8	16.3	17.5	18.0	18.4	19.5	20.0	19.3	19.5	18.9	17.1	18.0	18.5	19.1	18.5	18.6	18.3	17.9	17.9
Cincinnati, Ohio	6.5	6.3	6.0	5.8	5.5	5.8	5.8	5.7	5.6	6.5	7.4	8.2	9.6	9.5	8.9	8.9	18.2	7.4	7.9	7.7	7.5	7.2	6.9	6.7	7.3
Cleveland, Ohio	16.3	15.9	16.6	15.8	15.9	15.8	15.7	15.5	15.5	15.5	15.9	16.6	17.4	16.6	17.6	17.4	17.2	17.3	17.7	18.5	18.3	18.3	17.1	16.6	16.8
Columbia, Mo.	8.3	8.2	7.9	7.5	7.3	7.7	8.4	8.4	7.3	7.8	8.4	8.6	8.6	9.1	9.2	9.3	9.1	8.0	7.7	7.4	7.8	8.5	8.4	8.8	8.2
Columbus, Ohio	7.2	6.8	6.5	6.8	6.2	6.2	6.0	5.9	6.3	6.6	8.5	8.9	8.9	9.5	9.5	9.1	9.3	7.3	7.6	8.0	8.1	8.1	7.8	7.5	7.6
Concordia, Kans.	6.5	6.4	5.7	5.8	5.9	5.5	5.9	5.9	5.3	5.3	6.5	7.8	8.2	8.8	9.3	9.5	9.3	6.4	5.7	6.2	6.7	6.7	6.5	6.2	6.8
Corpus Christi, Tex.	7.6	8.4	7.9	8.2	7.8	7.9	8.4	7.9	8.2	8.5	8.4	9.0	9.8	9.3	9.3	9.0	8.7	8.4	9.3	8.5	8.1	8.1	8.4	7.1	8.7
Davenport, Iowa	7.8	7.5	7.4	7.4	7.5	7.8	7.9	7.9	7.9	7.9	8.4	9.0	9.1	10.4	10.1	10.5	10.1	9.4	8.4	8.1	8.1	7.8	7.8	7.8	8.5
Denver, Colo.	9.5	8.9	9.5	9.7	9.9	10.4	10.5	10.8	10.8	10.8	9.4	8.7	8.9	9.6	9.9	11.1	12.3	11.8	10.1	10.1	9.8	9.2	8.8	9.0	9.7
Des Moines, Iowa	7.0	7.8	7.2	7.6	7.6	7.0	7.5	7.2	7.9	8.3	8.3	8.8	9.4	9.3	9.5	9.6	9.6	8.6	7.3	7.4	8.0	7.7	6.7	7.2	7.9
Detroit, Mich.	12.0	11.6	11.2	11.2	11.3	11.3	11.2	11.1	11.4	12.1	13.3	13.3	13.9	14.1	14.4	14.5	14.6	14.2	13.7	13.9	13.1	12.9	13.7	12.4	12.7
Dodge, Kans.	7.9	7.3	7.6	7.4	7.3	7.5	7.3	7.0	7.7	8.0	8.1	10.6	11.8	12.1	12.8	13.0	13.5	12.5	7.3	6.4	6.5	6.6	6.5	7.7	8.9
Dubuque, Iowa	8.0	8.0	7.5	8.0	7.4	7.3	7.7	7.7	7.9	7.9	8.0	8.3	9.0	9.8	10.0	9.2	8.9	8.4	7.7	7.5	7.5	7.6	7.8	7.7	8.1
Duluth, Minn.	9.5	9.3	8.2	8.3	8.2	9.0	9.5	9.3	9.2	8.7	9.2	9.5	10.0	9.9	10.3	9.8	10.8	10.8	10.1	10.5	9.8	9.2	8.8	9.7	9.5
Eastport, Me.	12.5	10.9	10.6	10.8	10.6	10.9	11.1	11.7	12.1	12.1	12.3	12.1	11.5	11.4	12.3	9.8	9.8	9.7	10.2	10.5	10.1	10.5	10.7	11.2	10.9
Elkins, W. Va.	3.7	4.0	3.8	4.0	4.1	4.2	4.8	4.7	5.0	6.5	5.0	5.1	5.7	6.6	6.5	6.1	5.7	5.1	4.9	4.5	3.8	4.1	3.9	4.2	4.7
El Paso, Tex.	6.9	6.8	7.1	6.6	7.0	7.9	7.7	7.4	7.0	6.5	6.4	7.5	7.5	6.8	7.8	8.7	9.7	9.0	9.3	8.7	7.5	6.8	8.2	8.3	7.7
Erie, Pa.	13.5	13.0	13.1	12.7	12.8	12.4	12.4	12.5	12.6	12.6	12.1	12.2	12.7	13.3	12.5	12.6	12.1	12.4	9.3	8.4	8.9	9.3	9.8	9.2	9.6
Escanaba, Mich.	8.9	9.3	9.5	9.4	9.2	9.4	9.2	9.2	9.2	9.2	10.3	10.7	10.6	10.6	10.5	10.4	10.2	9.4	8.7	8.4	8.9	9.3	9.8	9.2	9.4
Eureka, Cal.	5.1	5.3	5.5	5.5	6.0	6.0	6.6	5.6	6.5	7.3	5.9	6.2	5.8	5.4	5.5	6.8	7.8	8.9	9.0	9.0	7.8	6.8	7.0	6.0	5.2
Evansville, Ind.	6.8	6.5	7.0	6.9	6.8	6.6	6.5	6.5	7.3	7.9	8.1	8.3	9.0	9.3	9.1	9.0	7.9	6.8	7.2	6.6	6.8	7.3	7.0	6.5	7.3
Fort Smith, Ark.	7.4	7.0	7.8	8.0	7.9	8.0	7.9	8.0	7.9	8.0	8.3	8.8	8.3	8.8	8.5	9.0	9.7	9.0	8.4	8.4	8.5	8.6	7.5	7.0	7.4
Fort Worth, Tex.	10.3	10.2	10.3	10.2	10.3	10.5	10.2	10.1	9.5	9.1	9.9	9.3	11.6	8.8	13.1	12.8	10.0	9.3	11.6	10.1	10.7	9.4	11.1	10.8	10.9
Fresno, Cal.	3.9	3.6	3.6	3.2	3.4	3.1	2.9	3.2	3.2	2.9	3.2	3.2	3.6	3.5	3.9	4.3	4.0	4.3	4.4	4.2	3.4	3.4	3.5	3.3	3.6
Galveston, Tex.	8.5	8.6	8.6	8.8	8.6	8.5	9.1	9.4	9.9	10.5	10.6	10.7	10.4	10.3	10.3	9.6	9.7	10.4	10.2	9.3	9.5	9.1	15.1	9.2	9.6
Grand Haven, Mich.	13.9	13.5	13.2	13.4	13.4	13.4	13.4	13.9	13.7	13.8	15.0	16.0	15.9	16.9	16.4	16.2	15.5	14.6	10.2	9.3	9.5	8.2	14.7	14.8	14.8
Grand Junction, Colo.	3.4	3.5	3.5	3.4	3.0	3.0	3.4	3.8	3.1	3.9	4.2	4.5	5.4	5.8	5.2	4.1	3.9	4.0	4.1	2.9	2.4	2.3	3.0	3.2	3.4
Green Bay, Wis.	9.6	9.3	9.4	9.2	9.2	8.5	8.5	8.8	8.6	9.5	10.5	10.5	10.5	10.6	10.2	9.7	9.8	9.4	8.3	8.3	8.6	9.0	9.5	9.7	9.7
Harrisburg, Pa.	6.4	6.4	6.4	6.2	6.6	6.1	5.8	5.9	6.1	7.2	7.8	8.3	8.5	8.5	8.7	8.6	7.6	7.1	7.1	7.1	7.1	7.3	7.4	7.3	7.2
Hatteras, N. C.	16.5	16.2	15.3	15.2	14.6	15.5	15.8	15.9	16.0	16.3	16.4	15.6	15.1	14.8	14.8	14.7	14.2	13.0	13.7	13.7	13.7	14.4	14.5	14.9	15.6	15 1
Havre, Mont.	12.3	12.3	12.8	11.5	11.7	11.4	12.1	12.6	11.8	12.0	12.0	12.1	14.0	14.8	15.3	15.1	14.5	14.2	13.7	13.9	12.2	11.7	11.7	12.6	11.9	12.9
Helena, Mont.	7.3	8.0	8.4	8.3	8.1	7.4	7.7	7.0	7.5	7.6	7.3	11.2	13.2	13.4	13.3	13.5	13.2	12.8	11.8	11.4	11.9	12.3	12.8	12.2	11.7	11.7
Huron, S. Dak.	11.7	11.1	11.0	11.1	10.9	10.4	10.1	10.2	9.7	10.4	11.2	13.2	13.4	13.3	13.5	13.2	12.8	11.8	11.4	11.6	11.0	10.8	10.1	10.9	11.7
Independence, Cal.	7.9	7.4	7.4	7.3	7.5	7.4	8.0	8.1	7.5	7.1	7.5	7.0	6.9	6.5	6.6	7.2	7.7	7.7	7.1	6.4	7.2	7.6	7.2	8.0	7.3
Indianapolis, Ind.	9.5	9.2	9.3	9.5	8.9	9.1	9.9	10.0	10.2	11.3	11.3	11.6	11.7	12.3	11.8	12.3	12.5	12.3	11.8	11.6	11.0	10.5	10.6	10.1	10.7
Jacksonville, Fla.	5.6	5.5	5.6	5.5	5.7	5.9	9.0	6.3	6.8	7.3	7.8	8.5	8.1	8.8	8.8	8.8	9.1	8.3	7.4	6.5	6.4	6.0	5.6	9.0	9.5
Jupiter, Fla.	9.3	9.4	9.1	9.2	9.3	9.0	8.7	8.6	9.6	11.7	12.5	12.5	12.3	12.6	13.2	12.9	12.9	11.5	10.3	10.3	9.9	9.5	8.6	8.8	9.8
Kalispell, Mont.	3.7	4.0	3.9	4.2	4.0	4.3	4.2	4.1	3.6	3.6	4.0	3.9	4.8	4.2	4.2	4.2	4.6	3.9	4.1	4.3	4.3	4.8	4.8	4.6	4.2
Kansas City, Mo.	7.1	7.5	7.5	7.4	7.6	7.1	7.5	7.5	7.6	8.1	8.8	8.8	8.7	9.4	9.5	9.1	9.5	9.2	8.5	7.4	7.8	8.0	7.9	8.3	7.5
Keokuk, Iowa	6.9	7.1	7.5	7.1	7.0	7.4	7.2	7.0	7.5	8.4	12.3	12.3	11.9	12.4	12.3	9.3	8.8	9.0	8.7	7.2	7.1	6.8	7.0	6.8	6.8
Key West, Fla.	10.9	10.6	10.7	11.2	11.3	11.1	11.2	11.4	11.3	11.8	16.9	16.9	16.2	16.1	15.4	12.6	12.0	10.8	9.8	10.1	10.3	10.5	10.2	10.5	10.7
Kittyhawk, N. C.	14.1	14.1	14.0	14.1	14.5	14.7	14.8	15.4	15.6	16.2	16.2	16.9	16.2	16.1	15.4	15.1	14.5	13.9	12.7	12.8	12.6	12.4	12.7	13.3	13.7
Knoxville, Tenn.	5.5	5.6	5.7	5.8	5.8	4.9	5.3	4.6	4.9	5.3	6.4	6.3	7.0	7.9	7.9	8.1	7.7	7.7	7.0	6.4	6.1	5.8	5.5	5.9	5.7
La Crosse, Wis.	8.3	8.2	8.2	8.0	7.4	7.1	7.3	7.0	6.8	7.1	7.2	8.0	8.3	8.4	8.3	8.3	8.3	7.8	7.1	7.1	7.6	8.1	8.0	8.2	8.2
Lander, Wyo.	2.7	3.2	2.9	2.9	3.0	3.1	3.3	3.0	2.8	2.7	2.1	2.5	3.2	4.5	4.8	4.8	4.5	4.8	4.0	3.0	3.0	3.0	2.4	2.3	3.1
Lexington, Ky.	10.0	9.9	9.8	9.3	9.5	9.6	10.3	9.5	9.7	10.2	10.9	10.9	11.8	12.8	12.2	12.3	11.6	10.1	9.5	9.6	9.5	10.3	10.3	9.9	10.1	10.4
Little Rock, Ark.	5.7	6.1	6.0	5.4	5.2	5.5	5.6	6.2	6.2	5.9	6.0	6.2	6.8	7.4	8.3	8.3	8.1	7.8	6.8	6.0	6.0	6.9	6.5	5.9	6.4
Los Angeles, Cal.	2.8	3.3	3.4	3.5	4.2	3.8	3.7	3.7	3.5	3.5	3.8	3.5	4.0	3.8	3.8	3.8	3.8	4.6	5.0	5.1	4.2	3.2	2.6	2.3	3.7
Louisville, Ky.	6.9	6.7	6.9	7.1	6.9	6.9	7.0	7.1	7.8	8.4	9.5	9.1	9.9	9.7	10.3	9.9	9.0	8.9	8.5	8.5	8.0	8.0	8.2	7.8	8.2
Lynchburg, Va.	2.4	2.5	3.1	2.7	2.6	2.8	3.2	3.0	2.7	3.0	3.9	4.2	4.6	5.0	4.9	4.5	3.5	3.5	3.4	3.5	2.9	2.3	2.7	2.9	3.3
Macon, Ga.	4.6	4.7	5.5	5.0	4.8	5.2	5.3	5.7	5.9	6.7	6.5	7.2	8.0	7.3	7.3	6.9	7.3	4.8	4.5	4.5	4.6	4.6	4.1	4.5	5.0
Marquette, Mich.	10.7	11.0	10.6	10.9	11.2	11.2	10.8	11.4	12.1	12.8	13.4	12.7	12.7	12.7	12.3	11.7	10.3	11.0	10.5	10.3	10.2	9.3	11.4	11.9	12.1
Memphis, Tenn.	10.2	10.4	10.0	10.4	9.5	9.4	9.4	9.4	9.2	9.7	10.3	10.3	10.3	9.7	10.4	10.6	11.0	11.0	10.6	9.7	8.8	9.3	9.9	10.4	10.6
Milwaukee, Wis.	11.4	11.0	10.8	10.8	10.5	10.3	10.4	10.7	11.3	11.9	13.0	13.6	13.5	12.8	12.6	12.5	11.7	10.1	10.1	10.5	9.8	9.7	11.2	11.0	11.3	11.4	11.5
Mobile, Ala.	5.9	5.8	5.7	6.2	6.5	6.2	6.2	5.9	5.9	6.2	6.6	7.1	7.5	6.8	7.3	7.1	7.4	7.9	7.7	7.4	7.0	6.5	5.8	5.8	5.8	6.2	6.6
Montgomery, Ala.	4.8	4.9	4.4	4.8	5.4	5.5	6.0	6.1	5.9	6.2	6.6	7.6	6.6	6.8	7.6	7.5	7.2	7.3	7.0	5.8	5.7	6.5	6.3	5.5	6.0	5.1	6.0
Moorhead, Minn.	11.6	11.4	10.8	10.9	10.9	10.5	10.2	10.4	10.7	10.7	11.3	11.9	13.0	13.6	13.5	12.8	12.6	12.5	11.7	11.4	11.6	12.1	11.5	11.8	12.1	12.2	11.6
Mount Tamalpais, Cal.	20.1	20.6	21.0	21.2	21.0	20.2	19.7	20.1	20.1	22.0	22.6	22.0	21.0	20.6	20.3	19.6	18.5	18.1	17.5	17.8	19.5	20.6	21.1	21.9	20.9	20.3
Nantucket, Mass.	14.7	15.2	15.0	15.2	15.4	16.2	15.4	15.2	15.0	14.8	14.8	15.9	15.7	15.7	15.0	13.6	14.6	14.8	15.3	15.1	14.5	13.5	14.2	14.8	15.0
Nashville, Tenn.	5.2	5.3	5.0	4.6	4.7	4.9	4.8	5.2	5.7	6.5	7.2	7.5	7.7	8.1	8.4	7.9	7.5	6.6	6.5	6.7	6.7	6.4	6.2	6.4
Neah Bay, Wash.	8.6	8.5	8.2	8.3	8.1	7.7	8.2	8.1	7.8	7.9	7.2	7.6	8.1	8.8	8.5	8.8	8.4	8.6	8.4	8.2	8.4	8.2	8.8	8.8	8.3
New Haven, Conn.	8.4	8.5	8.0	7.3	8.0	7.4	7.6	7.8	8.1	8.3	9.1	9.7	11.0	11.7	12.2	12.3	11.2	10.5	8.4	8.7	8.4	7.9	8.3	7.6	8.9
New Orleans, La.	7.2	7.9	7.4	7.5	7.6	7.5	7.5	7.6	7.5	7.6	8.3	8.2	8.0	8.2	8.6	8.9	8.5	8.2	7.2	7.9	6.7	6.9	7.0	7.2	7.6

TABLE V.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
New York, N. Y.	16.3	15.7	14.5	14.4	14.3	13.0	13.0	13.3	13.2	14.5	15.3	15.5	15.3	16.4	16.1	15.9	16.0	15.2	15.0	15.4	15.5	16.5	15.8	16.8	15.1
Norfolk, Va.	8.1	8.0	8.2	8.9	8.7	8.4	8.5	8.8	9.5	9.6	9.8	9.5	9.7	9.6	9.5	9.5	8.8	8.4	9.0	8.3	8.8	9.2	9.0	8.2	8.9
Northfield, Vt	7.0	6.5	6.7	5.9	5.9	6.1	5.3	6.2	6.2	6.5	6.8	7.7	8.5	8.9	8.9	6.9	6.6	6.3	7.3	7.2	6.6	6.7	6.6	7.0	6.9
North Platte, Nebr.	6.3	7.0	6.5	6.5	7.0	6.9	7.4	7.3	7.1	7.0	8.0	9.0	11 6	12.2	13.1	13.9	13.3	11.3	8.8	8.8	7.9	7.6	7.1	6.7	8.7
Oklahoma, Okla.	8.6	8.7	8.9	8.5	8.5	7.6	8.1	8.8	8.5	9.0	10.3	11.7	12.1	12.4	12.8	12.6	12.3	10.9	9.4	9.1	9.4	9.1	9.5	9.1	9.8
Omaha, Nebr	9.1	8.6	8.5	8.5	8.1	7.7	8.1	7.7	8.2	8.7	9.9	9.7	9.5	9.7	9.7	9.4	9.3	8.5	8.5	8.5	8.7	9.1	8.8	9.0	8.8
Oswego, N. Y.	12.0	11.5	11.1	11.1	11.0	10.9	10.8	11.2	11.5	12.0	12.2	11.7	12.3	12.2	12.3	11.9	12.1	11.6	12.3	12.4	12.5	12.0	11.7	11.9	11.8
Palestine, Tex.	6.1	6.3	6.2	6.6	6.1	6.5	6.2	6.5	6.9	7.0	7.3	7.6	8.2	8.3	9.0	9.3	9.4	8.7	6.2	6.1	6.4	6.6	6.7	6.9	7.1
Parkersburg, W. Va.	4.2	4.2	3.9	4.3	4.1	4.3	4.0	4.2	4.3	5.0	5.6	6.5	6.4	6.5	7.1	6.8	6.0	5.5	5.0	4.5	4.5	4.3	4.3	4.6	5.0
Pensacola, Fla.	7.2	7.8	7.8	8.1	8.0	8.4	8.4	7.7	7.8	8.8	8.9	8.7	9.2	8.7	8.1	7.8	7.6	6.7	6.3	6.6	6.6	7.0	7.3	7.1	7.8
Phoenix, Ariz	3.2	3.0	3.0	3.2	3.2	2.8	3.2	2.8	3.3	3.0	3.2	3.0	3.5	3.8	4.0	4.0	3.9	3.5	3.4	2.4	2.7	2.8	2.8	3.0	3.2
Philadelphia, Pa.	8.5	8.3	8.8	8.2	7.9	8.0	8.2	8.5	8.9	9.4	10.4	10.8	11.0	11.4	11.5	10.7	10.1	9.2	8.9	8.9	8.7	8.6	8.6	8.7	9.3
Pierre, S. Dak.	6.1	5.7	5.9	5.8	6.1	6 0	6.5	6.4	5.9	6.2	7.2	8.7	9.9	10.8	10.9	11.0	10.2	8.6	7.5	6.9	6.3	6.6	5.9	6.2	7.4
Pittsburg, Pa.	6.9	6.7	6.4	6.1	6.1	5.8	6.0	5.9	5.7	6.1	6.3	6.5	7.1	6.9	7.1	6.8	6.8	6.3	6.2	5.9	6.4	6.5	6.8	7.2	6.4
Pocatello, Idaho	11.0	11.5	12.3	13.6	14.5	13.5	12.1	12.3	11.6	11.1	12.0	12.0	12.4	12.4	11.4	10.1	10.2	9.4	9.7	10.2	10.4	12.5	12.3	10.9	11.6
Point Reyes Lt., Cal.	8.7	7.1	7.0	7.7	8.0	8.9	8.5	8.5	8.8	8.1	8.3	9.0	8.5	7.8	8.9	9.4	9.8	10.4	10.6	11.5	10.3	9.2	9.3	8.9	8.9
Port Crescent, Wash.	3.1	3.3	3.4	3.0	2.8	3.1	3.0	2.7	2.7	3.1	2.9	2.9	2.4	3.3	3.5	3.7	3.8	3.8	2.5	2.9	2.9	2.8	3.1	3.1	3.1
Port Huron, Mich.	11.5	11.2	11.0	11 6	12.0	11.9	11.5	11.4	12.1	12.8	14.1	14.7	15.4	15.4	15.3	14.9	13.8	12.6	12.4	12.5	13.3	12.2	12.1	11.7	12.8
Portland, Me.	8.1	8.1	8.3	7.7	7.5	7.0	7.5	7.5	8.2	8.5	8.6	8.2	8.2	8.3	8.0	7.8	7.5	7.6	7.9	8.1	8.0	8.3	8.1	8.9	8.0
Portland, Oreg.	8.5	8.2	8.0	8.0	7.5	8.5	7.9	8.5	8.2	7.4	7.7	7.8	7.9	9.3	8.4	8.5	8.4	8.8	9.1	7.9	8.5	8.4	9.1	8.9	8.3
Pueblo, Colo.	5.6	5.6	5.3	5.2	5.5	5.7	6.0	5.4	6.2	5.5	6.1	6.4	7.4	8.1	8.9	9.4	9.5	9.3	8.0	7.8	6.3	5.7	5.8	6.3	6.7
Raleigh, N. C.	4.5	4.6	4.8	4.8	4.7	4.8	4.6	4.6	4.8	6.3	6.2	6.6	6.7	7.0	7.0	6.6	5.4	4.2	4.5	4.7	4.4	4.6	4.6	4.5	5.2
Rapid City, S. Dak.	7.5	8.2	8.6	9.0	8.4	8.7	9.2	8.8	9.0	8.4	9.0	9.0	8.6	9.4	11.2	12.1	12.2	10.0	7.4	6.8	7.5	7.4	7.5	7.5	8.8
Red Bluff, Cal.	3.1	3.5	4.0	4.0	4.3	3.8	3.9	4.1	4.5	4.4	4.5	4.2	5.0	5.7	6.1	5.9	6.2	5.3	4.8	4.0	3.9	3.8	3.5	3.3	4.4
Richmond, Va.	3.7	3.9	3.8	3.8	4.1	4.1	4.2	4.7	4.9	5.5	5.9	6.1	6.7	6.8	6.2	6.3	5.4	4.5	4.3	4.0	4.1	4.4	4.2	4.1	4.8
Rochester, N. Y.	8.3	8.4	8.1	7.4	7.4	7.6	7.7	7.7	7.9	8.1	9.0	9.3	9.9	9.5	9.2	8.6	8.2	8.3	7.8	7.6	7.2	7.9	8.3	8.5	8.2
Roseburg, Oreg.	3 0	3.1	2.9	3.4	2.8	2.7	3.2	3.2	2.9	3.4	3.4	3.7	3.2	3.6	4.1	4.1	4.3	4.9	4.6	4.1	3.9	3.4	3.0	3.8	3.5
Sacramento, Cal.	6.5	5.6	5.7	5.7	5.5	5.5	5.9	6.0	5.9	5.8	6.4	6.0	6.5	7.0	7.2	6.9	6.9	6.9	7.0	6.5	6.5	6.5	6.5	6.5	6.3
St. Louis, Mo.	9.5	9.4	10.0	9.2	9.5	10.5	10.0	10.4	10.5	10.8	10.6	10.3	10.4	9.9	10.1	9.7	9.5	9.0	9.2	10.2	9.3	8.9	9.1	9.1	9.8
St. Paul, Minn.	8.1	8.7	8.4	8.3	8.1	8.6	8.8	8.8	9.0	9.0	9.0	9.4	9.8	9.6	9.8	10.0	9.4	8.6	8.8	9.1	9.0	9.0	8.8	8.6	8.9
Salt Lake City, Utah	3.7	3.5	3.9	4.3	4.2	4.0	4.3	3.8	3.7	4.1	4.0	3.4	3.9	5.1	5.5	6.5	7.1	5.9	5.6	4.4	4.7	4.6	3.7	3.7	4.5
San Antonio, Tex.	3.1	3.4	3.8	3.7	4.5	4.3	4.1	4.1	4.1	4.9	5.6	6.1	7.5	7.6	7.6	7.6	7.6	6.5	5.3	4.6	4.5	4.1	4.1	3.5	5.1
San Diego, Cal.	3.5	3.7	3.9	4.3	4.0	3.7	4.4	4.1	4.3	4.4	4.3	3.2	3.3	4.8	6.2	7.8	9.5	9.1	8.2	6.0	4.0	3.9	3.7	3.7	4.9
Sandusky, Ohio	8.5	7.9	7.4	6.7	6.8	7.2	6.8	7.1	7.0	7.7	8.6	9.6	9.5	9.7	9.8	9.0	8.8	8.4	8.9	9.5	9.1	9.3	8.9	8.8	8.4
San Francisco, Cal.	6.5	7.0	6.7	6.7	7.2	6.9	7.4	7.6	7.5	7.4	8.1	8.2	8.0	8.2	8.5	8.6	8.0	7.4	7.6	6.6	6.6	6.1	6.6	6.3	7.3
San Luis Obispo, Cal.	3.6	4.0	3.1	3.8	4.1	3.8	4.3	4.8	4.4	4.7	4.5	4.3	4.8	5.5	6.5	7.1	7.8	7.7	6.9	6.4	5.5	4.9	4.6	4.1	5.1
Santa Fe, N. Mex.	5.2	4.7	4.8	5.0	4.9	5.0	5.3	5.8	6.1	6.0	6.9	7.8	8.9	9.2	9.2	8.8	8.4	7.1	5.9	4.6	4.8	4.8	5.1	5.2	6.2
Sault Ste. Marie, Mich.	11.0	10.4	9.5	9.2	9.0	8.8	8.3	7.7	7.7	7.9	8.2	9.0	9.1	9.8	9.9	9.5	9.3	9.6	9.6	10.1	11.1	11.8	11.2	10.6	9.5
Savannah, Ga.	6 3	6.8	6.7	6.1	6.5	6.5	6.3	6.6	7.2	7.7	8.1	8.3	8.3	8.1	8.5	8.2	7.5	6.2	6.0	6.8	6.9	7.4	6.6	6.4	7.1
Seattle, Wash.	6.6	6.5	6.0	6.0	6.6	5.4	5.6	5.5	6.1	5.8	5.8	6.4	6.1	6.5	6.9	6.3	6.6	7.2	6.5	6.9	7.1	6.7	7.0	6.4	6.4
Shreveport, La.	6.0	5.7	5.5	5.6	6.1	5.5	5.9	5.9	6.1	6.5	6.8	7.1	7.8	8.0	7.7	7.5	7.6	7.9	6.9	6.8	6.6	6.8	7.1	7.1	6.7
Sioux City, Iowa	11.4	11.5	11.6	10.8	12.4	13.1	13.1	12.3	12.3	12.5	12.5	12.8	12.9	13.7	13.8	13.9	14.3	13.3	12.0	12.5	12.6	12.0	12.4	11.7	12.6
Spokane, Wash.	6.2	5.5	5.3	5.9	6.2	6.1	5.6	5.6	5.6	4.6	4.9	5.3	5.1	5.4	5.9	6.3	6.0	5.3	5.2	5.1	5.4	5.5	5.6	5.6	5.6
Springfield, Ill.	9.1	8.9	8.7	8.7	8.8	9.2	9.3	9.8	9.6	10.6	10.7	11.4	10.8	11.2	10.9	10.6	10.4	8.8	8.3	8.3	8.1	8.5	8.8	9.1	9.5
Springfield, Mo.	9.9	10.5	10.4	9.9	10.1	10.3	9.6	9.4	8.8	9.6	10.4	10.6	10.7	11.3	11.4	10.6	10.1	9.0	9.2	10.2	10.3	10.7	10.6	10.2	10.2
Tacoma, Wash.																									
Tampa, Fla.	5.2	5.0	5.3	5.8	5.7	5.1	5.4	5.5	6.5	7.5	7.9	8.2	8.1	8.3	8.0	7.6	7.8	6.0	5.3	5.3	5.6	5.1	5.2	5.0	6.2
Toledo, Ohio	9.7	8.9	8.7	8.7	8 9	8.9	8.9	8.8	9.4	9.6	10.4	11.3	12.1	12.6	12.6	12.6	11.7	11.2	11.1	11.2	10.7	10.5	10.4	9.9	10.4
Valentine, Nebr.	8.9	9.4	9.0	9.0	9.8	9.1	9.4	10.0	10.5	10.3	11.1	12.5	14.5	15.0	15.8	15.5	14.0	11.0	9.4	8.8	8.8	9.4	9.0	8.8	10.8
Vicksburg, Miss.	6.6	6.2	6.4	6.5	6.5	6.4	5.7	5.7	5.7	5.9	6.5	6.8	7.4	7.3	6.9	6.9	7.1	6.0	6.7	6.7	6.8	7.4	6.7	6.9	6.6
Walla Walla, Wash.	5.5	6.2	6.2	5.7	6.3	6.1	6.4	6.4	6.5	6.4	6.2	6.1	6.0	6.5	6.4	6.7	7.3	6.3	5.4	6.2	6.3	6.4	6.1	5.8	6.2
Washington, D. C.	4.7	4.7	4.7	4.0	3.7	3 9	4.0	4.7	5.4	6.4	7.5	7.6	8.0	8.3	8.5	7.5	6.3	5.7	5.7	5.2	5.0	5.2	5.2	4.7	5.7
Wichita, Kans.	7.6	7.5	7.0	6.9	6.8	6.5	6.3	6.5	6.7	6.9	8.2	9.2	10.8	10.8	11.5	12.0	11.0	9.3	7.5	7.1	6.9	7.0	7.1	7.2	8.1
Williston, N. Dak.	6.4	6.2	7.2	7.7	8.5	8.2	8.1	8.6	8.6	8.9	9.5	8.9	10.5	10.9	11.2	10.7	10.5	9.3	8.9	8.2	7.1	6.8	7.5	7.4	8.6
Wilmington, N. C.	6.4	6.2	6.8	7.4	7.5	7.3	7.3	7.8	8.3	8.6	8.9	8.8	9.1	9.0	9.4	9.2	8.2	7.3	6.6	7.0	6.6	6.4	6.3	6.5	7.6
Winnemucca, Nev.	8.3	7.1	7.7	7.9	8.0	7.1	7.4	6.9	7.6	8.2	7.9	7.7	7.8	7.8	10.1	10.8	10.5	9.8	9.7	8.5	8.2	8.7	8.0	7.7	8.3
Yankton, S. Dak.	8.4	8 0	8.6	8.4	7.9	8.1	8.3	8.1	8.2	8.0	8.4	9.4	10.2	10.8	10.5	10.9	10.3	9.8	8.4	8.8	8.5	8.2	8.1	8.6	8.9
West Indies.																									
Basseterre, St. Kitts	8.4	8.5	8.8	8.7	8.7	8 5	8.9	10.0	10.9	11.0	11.1	11.0	10.9	10.6	10.2	9.6	8.9	9.1	8.7	8.9	8.6	9.0	9.0	8.3	9.4
Bridgetown, Bar.	5.5	5.6	5.4	5.2	5.4	5.3	7.1	11.4	13.3	13.8	14.1	14.3	13.7	13.7	13.2	11.3	8.6	6.6	6.3	6.2	6.4	6.2	6.0	5.9	8.8
Cienfuegos, Cuba†	6.0	6.3	6.1	5.6	5.4	5.3	4.7	5.1	6.1	6.6	7.3	8.2	8.3	9.1	9.7	9.6	9.4	7.8	6.5	6.2	5.9	6.2	6.4	6.7	6.9
Havana, Cuba	8.7	8.1	7.8	7.5	7.5	8.2	8.4	8.4	9.2	11.5	12.4	12.6	13.8	14.5	15.4	16.1	15.4	13.9	12.5	10.6	10.0	10.2	9.9	9.5	10.9
Kingston, Jamaica	4.9	4.7	5.3	5.2	5.1	5.2	5.0	4.8	3.5	3.9	4.2	5.4	7.3	7.9	7.8	7.5	6.7	5.0	4.7	4.8	4.7	4.9	4.9	4.9	5.3
Port of Spain, Trin.																									
Puerto Principe, Cuba	4.4	4.3	4.5	4.2	3.8	3.8	3.5	4.2	7.3	10.6	10.3	9.8	9.1	9.3	9.0	9.0	9.0	8.0	6.3	5.3	4.9	4.7	4.4	4.2	6.4
Roseau, Dominica	4.3	4.4	4.6	4.	4.5	4.4	4.3	4.3	4.7	5.9	6.4	6.8	7.0	6.6	5.9	4.8	4.5	4.7	4.4	4.4	4.3	4.2	4.3	4.2	4.9
San Juan, Porto Rico	5.3	5.2	5.5	4.7	4.9	5.2	5.7	6.1	9.2	12.6	14.1	15.1	15.5	14.9	14.8	14.4	12.8	11.4	9.3	8.5	6.5	5.9	5.8	5.5	9.1
Santiago de Cuba	2.6	2.3	2.3	2.4	2.5	2 2	2.6	2.8	3.9	4.7	5.4	5.3	5.9	6.1	5.7	5.0	4.3	3.0	2.5	2.7	3.0	2.9	2.8	2.7	3.6
Santo Domingo, S. D.																									
Willemstad, Curaçao	9.6	9.0	9.1	9.0	9.0	8.6	8.8	11.4	13.7	14.1	14.6	14.8	14.5	14.8	14.8	14.4	13.2	11.4	10.5	10.4	10.1	10.0	10.0	9.8	11.5

* For 20 days. † For 27 days.

TABLE VI.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of December, 1900.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	25	4	6	37	n. 56 w.	37
Portland, Me	19	18	2	41	n. 88 w.	39
Northfield, Vt	23	32	2	12	s. 48 w.	14
Boston, Mass	16	19	1	41	s. 86 w.	40
Nantucket, Mass	27	12	6	30	n. 58 w.	28
Block Island, R. I	24	10	6	38	n. 66 w.	35
New Haven, Conn	23	15	2	35	n. 76 w.	34
Middle Atlantic States.						
Albany, N. Y	19	29	4	20	s. 58 w.	19
Binghamton, N. Y.†	12	8	3	19	n. 76 w.	16
New York, N. Y	23	11	3	37	n. 71 w.	36
Harrisburg, Pa.†	9	6	4	18	n. 78 w.	14
Philadelphia, Pa	22	14	6	27	n. 69 w.	22
Scranton, Pa	22	20	9	32	n. 85 w.	22
Atlantic City, N. J	27	8	5	32	n. 56 w.	34
Cape May, N. J.	24	16	4	32	n. 74 w.	29
Baltimore, Md	18	15	9	28	n. 81 w.	19
Washington, D. C	24	18	5	30	n. 77 w.	24
Lynchburg, Va	15	25	10	31	s. 65 w.	23
Norfolk, Va	19	25	15	18	s. 27 w.	7
Richmond, Va	23	26	8	18	s. 73 w.	10
South Atlantic States.						
Charlotte, N. C	19	22	23	15	s. 69 e.	8
Hatteras, N. C	31	12	12	21	n. 25 w.	21
Kittyhawk, N. C*	14	4	9	10	n. 6 w.	10
Raleigh, N. C	24	16	10	22	n. 56 w.	14
Wilmington, N. C	30	9	13	21	n. 21 w.	22
Charleston, S. C	32	9	19	16	n. 7 e.	23
Augusta, Ga	23	6	19	23	n. 19 w.	18
Savannah, Ga	29	7	17	20	n. 8 w.	22
Jacksonville, Fla	29	14	15	18	n. 11 w.	15
Florida Peninsula.						
Jupiter, Fla	24	15	16	23	n. 38 w.	11
Key West, Fla	27	14	34	5	n. 66 e.	32
Tampa, Fla	35	10	19	9	n. 22 e.	27
Eastern Gulf States.						
Atlanta, Ga	17	18	19	23	s. 76 w.	4
Macon, Ga†	17	5	5	9	n. 18 w.	13
Pensacola, Fla.†	21	1	13	6	n. 19 e.	21
Mobile, Ala	36	12	10	16	n. 14 w.	25
Montgomery, Ala	20	11	23	19	n. 24 e.	10
Meridian, Miss.†	14	3	9	12	n. 10 w.	11
Vicksburg, Miss	22	16	19	18	n. 9 e.	6
New Orleans, La	28	14	23	12	n. 38 e.	18
Western Gulf States.						
Shreveport, La	15	21	18	14	s. 34 e.	7
Fort Smith, Ark	22	12	23	19	n. 22 e.	11
Little Rock, Ark	17	21	14	24	s. 68 w.	11
Corpus Christi, Tex	35	9	22	13	n. 19 e.	28
Fort Worth, Tex†	17	23	9	20	s. 61 w.	12
Galveston, Tex	30	10	21	15	n. 17 e.	21
Palestine, Tex	17	26	13	23	s. 48 w.	14
San Antonio, Tex	28	15	18	16	n. 9 e.	13
Ohio Valley and Tennessee.						
Chattanooga, Tenn	20	18	15	22	n. 74 w.	7
Knoxville, Tenn	21	19	19	22	n. 56 w.	4
Memphis, Tenn	18	23	19	14	s. 45 e.	7
Nashville, Tenn	18	20	17	22	s. 68 w.	5
Lexington, Ky†	10	11	6	12	s. 80 w.	6
Louisville, Ky	19	21	15	21	s. 72 w.	6
Evansville, Ind.†	10	11	9	9	s.	1
Indianapolis, Ind	16	25	11	23	s. 53 w.	15
Cincinnati, Ohio	18	21	23	20	s. 21 e.	8
Columbus, Ohio	11	27	19	23	s. 14 w.	16
Pittsburg, Pa	17	19	12	29	s. 83 w.	17
Parkersburg, W. Va	18	25	7	25	s. 69 w.	19
Elkins, W. Va	17	15	9	30	n. 85 w.	21
Lower Lake Region.						
Buffalo, N. Y	8	20	6	34	s. 67 w.	30
Oswego, N. Y	10	36	19	16	s. 7 e.	26
Rochester, N. Y	4	33	4	34	s. 46 w.	42
Erie, Pa	11	30	4	30	s. 54 w.	32
Cleveland, Ohio	10	34	13	23	s. 23 w.	26
Sandusky, Ohio	9	27	8	32	s. 53 w.	30
Toledo, Ohio	11	29	6	30	s. 53 w.	30
Detroit, Mich	14	21	6	34	s. 76 w.	29
Upper Lake Region.						
Alpena, Mich	21	17	3	36	n. 83 w.	33
Escanaba, Mich	18	22	6	29	s. 80 w.	23
Grand Haven, Mich	18	30	15	25	s. 79 w.	10
Houghton, Mich†	12	4	9	13	n. 27 w.	9
Marquette, Mich	17	27	5	29	s. 67 w.	26
Port Huron, Mich	12	28	3	32	s. 61 w.	33
Sault Ste. Marie, Mich	20	20	21	16	e.	5
Chicago, Ill	12	24	10	30	s. 59 w.	23
Milwaukee, Wis.	17	15	5	39	n. 87 w.	34
Green Bay, Wis	11	26	6	28	s. 56 w.	27
Duluth, Minn	22	20	5	32	n. 86 w.	27
North Dakota.						
Moorhead, Minn	17	24	14	27	s. 62 w.	15
Bismarck, N. Dak	28	15	11	27	n. 51 w.	21
Williston, N. Dak	25	16	6	26	n. 66 w.	22
Upper Mississippi Valley.						
St. Paul, Minn	22	22	10	26	w.	16
Upper Mississippi Valley.—Con'd.						
La Crosse, Wis. †	8	15	3	11	s. 49 w.	11
Davenport, Iowa	12	18	10	33	s. 75 w.	24
Des Moines, Iowa	23	21	12	21	n. 77 w.	9
Dubuque, Iowa	9	19	12	31	s. 62 w.	22
Keokuk, Iowa	17	17	12	30	w.	18
Cairo, Ill	22	22	14	17	w.	3
Springfield, Ill	19	20	10	21	s. 85 w.	11
Hannibal, Mo†	11	8	6	12	n. 66 w.	7
St. Louis, Mo	22	20	10	19	n. 77 w.	9
Missouri Valley.						
Columbia, Mo.*	12	8	8	11	n. 37 w.	5
Kansas City, Mo	24	23	11	20	n. 84 w.	9
Springfield, Mo	21	24	9	18	s. 72 w	10
Lincoln, Nebr	27	22	7	19	n. 67 w.	13
Omaha, Nebr	21	23	13	19	s. 72 w.	6
Valentine, Nebr	24	8	2	40	n. 67 w.	41
Sioux City, Iowa†	11	11	5	12	w.	7
Pierre, S. Dak	24	12	18	21	n. 14 w.	12
Huron, S. Dak	19	22	15	25	s. 73 w.	10
Yankton, S. Dak†	10	6	4	17	n. 73 w.	14
Northern Slope.						
Havre, Mont	12	19	11	38	s. 75 w.	28
Miles City, Mont	19	27	6	21	s. 62 w.	17
Helena, Mont	11	26	2	31	s. 62 w.	33
Kalispell, Mont	15	16	5	40	s. 88 w.	35
Rapid City, S. Dak	21	7	7	41	n. 69 w.	40
Cheyenne, Wyo	29	8	0	39	n. 62 w.	44
Lander, Wyo	12	31	15	26	s. 30 w.	22
North Platte, Nebr	16	15	2	39	n. 88 w.	37
Middle Slope.						
Denver, Colo	17	30	5	23	s. 54 w.	22
Pueblo, Colo	28	9	20	20	n.	19
Concordia, Kans	19	30	5	18	s. 50 w.	17
Dodge, Kans	33	10	5	21	n. 35 w.	28
Wichita, Kans	29	22	8	14	n. 41 w.	9
Oklahoma, Okla	27	22	7	14	n. 54 w.	9
Southern Slope.						
Abilene, Tex	20	26	8	21	s. 65 w.	14
Amarillo, Tex	31	14	4	27	n. 54 w.	29
Southern Plateau.						
El Paso, Tex	25	3	9	39	n. 54 w.	37
Santa Fe, N. Mex	28	12	31	5	n. 58 e.	30
Flagstaff, Ariz	20	11	32	12	n. 66 e.	22
Phoenix, Ariz	21	11	29	15	n. 54 e.	17
Yuma, Ariz	43	2	17	9	n. 11 e.	42
Independence, Cal	33	10	5	34	n. 52 w.	37
Middle Plateau.						
Carson City, Nev	18	18	18	18		
Winnemucca, Nev	20	23	17	20	s. 45 w.	4
Cedar City, Utah‡	10	20	17	8	s. 42 e.	14
Salt Lake City, Utah	27	16	13	21	n. 36 w.	14
Grand Junction, Colo	20	16	23	15	n. 63 e.	9
Northern Plateau.						
Baker City, Oreg	7	37	16	7	s. 17 e.	31
Boise, Idaho	15	27	18	22	s. 18 w.	13
Lewiston, Idaho†	2	3	21	5	s. 87 e.	16
Pocatello, Idaho	15	31	8	15	s. 24 w.	18
Spokane, Wash	17	26	21	13	s. 42 e.	12
Walla Walla, Wash	7	41	10	15	s. 8 w.	34
North Pacific Coast Region.						
Neah Bay, Wash	2	21	32	19	s. 34 e.	23
Port Crescent, Wash*	0	13	12	13	s. 4 w.	13
Seattle, Wash	12	33	27	6	s. 45 e.	30
Tacoma, Wash	10	41	13	12	s. 2 e.	31
Astoria, Oreg	17	21	24	18	s. 56 e.	7
Portland, Oreg	13	30	14	20	s. 19 w.	18
Roseburg, Oreg	19	21	20	16	s. 63 e.	4
Middle Pacific Coast Region.						
Eureka, Cal	19	22	19	22	s. 45 w.	4
Mount Tamalpais, Cal	31	17	15	13	n. 8 e.	15
Red Bluff, Cal	24	22	23	6	n. 83 e.	17
Sacramento, Cal	26	24	22	7	n. 82 e.	15
San Francisco, Cal	38	11	9	16	n. 15 w.	28
South Pacific Coast Region.						
Fresno, Cal	19	18	20	17	n. 72 e.	3
Los Angeles, Cal	31	6	16	26	n. 22 w.	27
San Diego, Cal	40	4	15	16	n. 2 w.	36
San Luis Obispo, Cal	46	0	0	19	n. 22 w.	50
West Indies.						
Basseterre, St. Kitts Island	11	1	55	0	n. 80 e.	56
Bridgetown, Barbados	7	1	58	0	n. 84 e.	56
Cienfuegos, Cuba§	31	7	31	5	n. 47 e.	35
Grand Turk, Turks Island, W. I.	9	9	23	0	e.	23
Havana, Cuba	17	10	39	3	n. 79 e.	37
Kingston, Jamaica	53	1	20	1	n. 22 e.	56
Port of Spain, Trinidad	27	12	49	4	n. 72 e.	47
Puerto Principe, Cuba	39	3	38	1	n. 46 e.	52
Roseau, Dominica, W. I	25	2	42	7	n. 57 e.	42
San Juan, Porto Rico	2	25	46	1	s. 63 e.	50
Santiago de Cuba, Cuba	33	17	21	5	n. 45 e.	23
Santo Domingo, S. Domingo, W. I.	53	2	10	2	n. 9 e.	51
Willemstad, Curaçao	2	0	61	0	n. 89 e.	61

* From observations at 8 p. m. only. † From observations at 8 a. m. only. ‡ Record for 20 days. § Record for 27 days.

TABLE VII.—*Thunderstorms and auroras, December, 1900.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.																						2	3					1			2	8	4	T.
		A.																																0	1	A.
Arizona	56	T.																											1					1	1	T.
		A.																																0	0	A.
Arkansas	57	T.				1			1												6			7	1			1	6	1			24	8	T.
		A.																																0	0	A.
California	167	T.														21		2	1															24	3	T.
		A.																																0	0	A.
Colorado	81	T.																																0	1	T.
		A.						1																										0	0	A.
Connecticut	21	T.																																1	1	T.
		A.																																0	0	A.
Delaware	5	T.																																0	0	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.																																0	0	T.
		A.																																0	0	A.
Florida	47	T.										1			1	1						1		7	1				1	1			14	8	T.
		A.																																0	0	A.
Georgia	55	T.																						8	1						13	1	23	4	T.
		A.																																0	0	A.
Idaho	34	T.																			1													1	1	T.
		A.																																0	0	A.
Illinois	92	T.																						14	7				3					24	3	T.
		A.																																0	0	A.
Indiana	58	T.																							1									1	1	T.
		A.		1								1																						2	2	A.
Indian Territory	11	T.																		1	2							1						4	3	T.
		A.																																0	0	A.
Iowa	149	T.																																1	1	T.
		A.																																0	0	A.
Kansas	77	T.																					1						2					3	2	T.
		A.																																0	0	A.
Kentucky	41	T.																						2					1					3	2	T.
		A.																																0	0	A.
Louisiana	46	T.	1		1															1	1						1	4	3		1	4	17	9	T.
		A.																																0	0	A.
Maine	19	T.																																0	0	T.
		A.																																0	0	A.
Maryland	48	T.																																0	1	T.
		A.																																0	0	A.
Massachusetts	48	T.																											1					1	1	T.
		A.																																0	0	A.
Michigan	106	T.							1															1										2	2	T.
		A.																																0	0	A.
Minnesota	67	T.																																0	0	T.
		A.										1	1																					2	2	A.
Mississippi	44	T.																			3			2					1	1		1	8	5	T.
		A.																																0	0	A.
Missouri	95	T.																						17					7					24	2	T.
		A.																					1											1	1	A.
Montana	40	T.																				1												1	1	T.
		A.						1																										1	1	A.
Nebraska	142	T.																					2	1										3	2	T.
		A.	1																															1	1	A.
Nevada	40	T.																																0	0	T.
		A.				1	1	1	1																									4	4	A.
New Hampshire	19	T.																																0	0	T.
		A.																																0	0	A.
New Jersey	51	T.				1																				5								6	2	T.
		A.																																0	0	A.
New Mexico	31	T.																																0	0	T.
		A.																																0	0	A.
New York	99	T.																					1		1	2								4	3	T.
		A.																		1														1	1	A.
North Carolina	56	T.		1																					3									4	2	T.
		A.					1																											1	1	A.
North Dakota	48	T.																																0	0	T.
		A.																																0	0	A.
Ohio	128	T.																											1					1	1	T.
		A.			1							1				1								1				1						5	4	A.
Oklahoma	23	T.																																0	0	T.
		A.																																0	0	A.
Oregon	74	T.																11	1	2	4	2	2		1									23	7	T.
		A.																																0	0	A.
Pennsylvania	91	T.																																0	0	T.
		A.																																0	0	A.
Rhode Island	7	T.																																0	0	T.
		A.																																0	0	A.
South Carolina	46	T.																				1		8	1					2	1			13	5	T.
		A.																																0	0	A.
South Dakota	56	T.																																0	0	T.
		A.				1														1	1													3	3	A.
Tennessee	56	T.																						5	2				1					8	3	T.
		A.																																0	0	A.
Texas	95	T.																		1	2						1	2	1		1			8	6	T.
		A.																																0	0	A.
Utah	47	T.																																0	0	T.
		A.																																0	0	A.
Vermont	16	T.																																0	0	T.
		A.																																0	0	A.
Virginia	50	T.																							2									2	1	T.
		A.																																0	0	A.
Washington	64	T.																4	1	1	1													7	4	T.
		A.																																0	0	A.
West Virginia	43	T.																																0	0	T.
		A.																																0	0	A.
Wisconsin	60	T.																																0	0	T.
		A.																																0	0	A.
Wyoming	31	T.																																0	0	T.
		A.																											1					1	1	A.
Sums	2,898	T.	1	1	1	2	0	0	1	1	0	1	0	0	1	22	0	17	3	6	20	5	6	51	44	10	0	4	28	9	1	17	9	261		T.
		A.	1	1	1	2	2	3	1	0	0	3	1	0	0	1	0	0	0	2	1	0	1	0	1	0	0	0	2	1	0	0	1	25		A.

TABLE VIII.—*Average hourly sunshine (in percentages), December, 1900.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			Personal estimate.
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	
																		Hours.	*Hours*		
Albany, N. Y	T.	.....	.....	.....	6	10	22	43	42	43	42	39	26	16	.....	.....	.....	86.1	281.0	31	26
Atlanta, Ga	T.	.....	.....	33	24	45	53	59	64	66	66	59	45	39	.....	....	.....	160.0	307.7	52	49
Atlantic City, N. J	T.	.....	.....	.....	53	61	65	75	81	70	66	63	56	55	.....	.....	.....	191.2	293.7	65	54
Baltimore, Md	T.	.....	.....	.....	27	35	53	62	65	64	58	54	42	29	.....	.....	.....	147.3	293.7	50	41
Binghamton, N. Y	T.	.....	.....	.....	13	23	35	45	49	49	39	30	17	10	.....	.....	.....	93.5	284.7	33	19
Bismarck, N. Dak	P.	.....	.....	.....	37	41	42	47	46	39	52	52	40	37	.....	.....	.....	118.0	265.6	44	52
Boise, Idaho	P.	.....	.....	.....	20	22	32	35	26	29	40	38	35	37	.....	.....	.....	87.6	277.7	32	30
Boston, Mass	T.	.....	.....	.....	24	46	53	60	61	61	54	46	39	39	.....	.....	.....	141.8	284.7	50	44
Buffalo, N. Y	T.	.....	.....	.....	3	4	8	23	30	17	20	20	14	11	.....	.....	.....	41.3	281.0	15	9
Cedar City, Utah	T.	.....	.....	82	31	36	58	74	72	70	77	70	66	69	.....	.....	.....	119.8	191.7	62	62
Charleston, S. C	T.	.....	.....	24	23	26	39	40	49	54	54	49	33	26	11	.....	.....	121.5	310.7	39	43
Chattanooga, Tenn	T.	.....	.....	45	39	32	44	62	65	63	50	45	38	38	.....	.....	.....	145.7	305.2	48	49
Cheyenne, Wyo	P.	.....	.....	.....	52	65	73	79	73	63	71	68	61	62	.....	.....	.....	194.0	287.8	67	63
Chicago, Ill	T.	.....	.....	.....	27	27	29	36	50	51	51	38	32	27	.....	.....	.....	107.1	284.7	38	36
Cincinnati, Ohio	T.	.....	.....	.....	10	29	37	45	49	49	46	40	34	31	.....	.....	.....	110.7	293.7	38	36
Cleveland, Ohio	T.	.....	.....	.....	14	12	15	28	32	33	31	22	28	28	.....	.....	.....	69.6	284.7	24	20
Columbia, Mo	T.	.....	.....	.....	54	57	64	73	77	75	71	67	55	49	.....	.....	.....	190.8	293.7	65	46
Columbus, Ohio†	T.	.....	.....	.....	24	26	37	48	45	44	42	36	26	20	.....	.....	.....	83.7	234.5	36	30
Denver, Colo	P.	.....	.....	.....	65	76	84	83	81	90	84	77	70	53	.....	.....	.....	226.0	291.7	77	65
Des Moines, Iowa	T.	.....	.....	.....	17	21	29	41	47	49	54	50	43	39	.....	.....	.....	113.8	284.7	40	35
Detroit, Mich	T.	.....	.....	.....	0	8	27	39	41	38	45	27	9	4	.....	.....	.....	73.5	284.7	26	34
Dodge, Kans	P.*	.....	.....	64	79	81	78	74	79	83	86	86	82	71	.....	.....	.....	237.9	296.7	80	69
Dubuque, Iowa	T.	.....	.....	.....	28	31	38	50	56	47	46	40	35	36	.....	.....	.....	117.9	284.7	41	38
Eastport, Me	P.	.....	.....	.....	24	30	44	48	47	47	54	49	44	41	.....	.....	.....	120.6	274.3	44	37
Elkins, W. Va	T.	.....	.....	.....	0	3	16	32	38	40	34	31	18	10	.....	.....	.....	67.8	293.7	23	28
Erie, Pa	T.	.....	.....	.....	3	4	9	15	25	26	20	11	13	21	.....	.....	.....	42.0	284.7	15	22
Escanaba, Mich	T.	.....	.....	.....	12	13	18	21	22	24	21	20	9	9	.....	.....	.....	48.2	269.6	18	18
Eureka, Cal	P.	.....	.....	.....	27	30	47	54	51	50	52	53	45	38	.....	.....	.....	131.1	287.8	46	47
Fresno, Cal	T.	.....	.....	0	3	3	3	3	4	15	21	15	12	11	.....	.....	.....	26.9	299.4	9	16
Galveston, Tex	P.	.....	.....	15	33	47	49	58	52	46	57	56	45	46	50	.....	.....	154.3	320.2	48	42
Grand Junction, Colo	P.	.....	.....	.....	90	81	81	84	86	88	89	80	75	76	.....	.....	.....	244.1	293.7	83	70
Harrisburg, Pa	T.	.....	.....	.....	35	34	36	38	50	51	47	43	44	42	.....	.....	.....	123.0	291.7	42	41
Helena, Mont	P.	.....	.....	.....	6	13	34	50	48	50	51	48	41	41	.....	.....	.....	107.4	265.6	40	36
Huron, S. Dak	T.	.....	.....	.....	48	47	43	47	48	52	55	54	51	47	.....	.....	.....	137.1	277.7	49	43
Indianapolis, Ind	T.	.....	.....	.....	54	45	41	45	41	46	41	37	32	31	.....	.....	.....	120.8	291.7	41	35
Jacksonville, Fla	T.	.....	.....	20	26	32	43	45	51	50	47	43	30	20	19	.....	.....	121.3	317.8	38	36
Jupiter, Fla	T.	.....	.....	18	26	49	61	68	65	56	55	51	33	20	19	.....	.....	152.7	324.0	47	40
Kalispell, Mont	T.	.....	.....	.....	3	8	15	21	25	29	27	17	7	0	.....	.....	.....	46.9	262.1	18	15
Kansas City, Mo	P.	.....	.....	.....	64	56	59	56	59	63	65	58	51	58	.....	.....	.....	172.8	293.7	59	57
Knoxville, Tenn	T.	.....	.....	50	43	47	53	59	60	64	65	55	48	44	.....	.....	.....	163.7	302.5	54	46
Lexington, Ky	T.	.....	.....	36	14	22	43	51	54	53	50	52	41	38	.....	.....	....	125.1	296.7	42	44
Little Rock, Ark	T.	.....	.....	36	45	50	52	56	64	66	63	66	65	61	.....	.....	.....	180.0	305.2	59	50
Los Angeles, Cal	P.	.....	.....	69	77	89	89	92	95	94	94	94	91	78	100	.....	.....	275.2	307.7	89	79
Louisville, Ky	T.	.....	.....	0	29	30	43	52	48	56	56	44	41	41	.....	.....	.....	131.8	296.7	44	45
Macon, Ga	T.	.....	.....	12	16	39	53	61	65	66	67	62	43	26	11	.....	.....	154.7	310.7	50	44
Meridian, Miss	T.	.....	.....	36	35	35	43	48	56	56	48	49	40	39	17	.....	.....	140.6	313.0	45	43
Mount Tamalpais, Cal	P.	.....	.....	100	56	59	60	65	54	59	66	62	60	60	.....	.....	.....	178.7	296.7	60	57
Nashville, Tenn	T.	.....	.....	67	47	45	58	70	69	66	64	60	55	54	.....	.....	.....	178.8	302.5	59	54
New Haven, Conn	T.	.....	.....	.....	42	54	65	71	75	75	64	57	45	32	.....	.....	.....	171.9	287.8	60	52
New Orleans, La	T.	.....	.....	24	21	26	38	48	48	49	45	38	22	23	29	.....	.....	112.7	317.8	35	36
New York, N. Y	T.	.....	.....	.....	58	59	62	71	71	66	60	56	53	51	.....	.....	.....	176.4	287.8	61	52
Norfolk, Va	T.	.....	.....	50	18	33	48	59	60	68	63	49	36	22	.....	.....	.....	138.9	299.4	46	53
Northfield, Vt	P.	.....	.....	.....	21	24	42	48	48	39	37	32	26	22	.....	.....	.....	97.9	277.7	35	33
Oklahoma, Okla	T.	.....	.....	73	58	59	62	64	62	62	57	53	52	51	.....	.....	.....	177.3	305.2	58	54
Omaha, Nebr	T.	.....	.....	.....	42	48	57	58	59	66	56	58	50	49	.....	.....	.....	158.5	287.8	55	46
Parkersburg, W. Va	T.	.....	.....	.....	4	7	16	33	36	36	37	28	17	15	.....	.....	.....	69.7	293.7	24	24
Philadelphia, Pa	T.	.....	.....	.....	53	53	63	71	73	70	64	62	52	46	.....	.....	.....	179.5	291.7	62	51
Phoenix, Ariz	P.	.....	.....	88	84	89	98	98	93	96	93	94	91	81	100	.....	.....	285.1	310.7	92	87
Pittsburg, Pa	T.	.....	.....	.....	7	6	10	12	17	25	24	23	17	16	.....	.....	.....	46.1	287.8	16	28
Pocatello, Idaho	T.	.....	.....	.....	25	29	37	48	52	52	47	40	21	20	.....	.....	.....	108.3	281.0	39	26
Portland, Me	T.	.....	.....	.....	29	46	61	70	75	74	70	67	45	27	.....	.....	.....	166.0	277.7	60	49
Portland, Oreg	T.	.....	.....	.....	7	6	8	11	16	20	19	18	13	15	.....	.....	.....	37.5	269.6	14	23
Pueblo, Colo	T.	.....	.....	55	60	75	85	90	97	96	94	89	77	68	.....	.....	.....	249.2	296.7	84	60
Raleigh, N. C	T.	.....	.....	67	46	50	63	65	65	69	67	59	43	42	.....	.....	.....	173.4	302.5	57	54
Rochester, N. Y	T.	.....	.....	.....	2	1	7	15	18	8	15	16	2	2	.....	.....	.....	26.3	281.0	9	8
St. Louis, Mo	T.	.....	.....	.....	34	36	44	58	61	65	61	55	49	42	.....	.....	.....	150.3	293.7	51	48
St. Paul, Minn	P.	.....	.....	.....	22	23	28	41	45	47	47	49	33	29	.....	.....	.....	102.9	274.3	38	37
Salt Lake City, Utah	T.	.....	.....	.....	24	28	42	51	49	57	56	47	37	43	.....	.....	.....	127.1	287.8	44	45
San Diego, Cal	P.	.....	.....	84	77	90	95	92	90	94	92	96	93	90	96	.....	.....	282.1	310.7	91	86
San Francisco, Cal	T.	.....	.....	100	39	48	54	62	73	75	73	70	59	46	.....	.....	.....	180.0	296.7	61	50
Santa Fe, N. Mex	P.	.....	.....	100	87	89	94	96	97	97	96	95	88	90	.....	.....	.....	281.1	302.5	93	85
Sault Ste. Marie, Mich	T.	.....	.....	.....	4	11	23	32	36	37	34	27	15	0	.....	.....	.....	67.1	269.6	25	15
Savannah, Ga	T.	.....	.....	30	26	30	44	47	43	47	49	45	40	41	17	.....	.....	128.7	313.0	41	42
Seattle, Wash	T.	.....	.....	.....	2	5	10	20	31	26	22	14	11	10	.....	.....	.....	43.8	262.1	17	18
Spokane, Wash	T.	.....	.....	.....	11	8	16	23	21	22	22	16	7	10	.....	.....	.....	43.3	262.1	17	9
Tacoma, Wash	T.	.....	.....	.....	2	3	4	7	17	17	16	14	7	10	.....	.....	.....	27.6	265.6	10	12
Tampa, Fla	T.	.....	.....	27	29	31	36	37	48	47	46	35	30	29	27	.....	.....	117.8	322.9	36	30
Toledo, Ohio	T.	.....	.....	.....	16	15	21	32	32	35	29	16	14	14	.....	.....	.....	64.8	284.7	23	29
Topeka, Kans	T.	.....	.....	.....	47	45	46	53	54	60	58	50	44	45	.....	.....	.....	148.2	293.7	50	54
Vicksburg, Miss	T.	.....	.....	45	39	45	50	57	57	60	61	60	60	55	17	.....	.....	169.3	313.0	54	50
Washington, D. C	P.	.....	.....	.....	39	46	56	62	61	61	57	59	55	45	.....	.....	.....	160.5	293.7	55	54
Wilmington, N. C	T.	.....	.....	22	26	49	75	79	77	76	71	62	55	40	67	.....	.....	188.0	307.7	61	48
Yankton, S. Dak	T.	.....	.....	.....	7	21	42	51	59	63	55	49	46	46	.....	.....	.....	127.5	281.0	45	45
Basseterre, St. Kitts	T.	.....	.....	25	42	72	81	85	87	85	82	87	69	54	34	.....	.....	241.0	345.3	70	54
Bridgetown, Barbados	T.	.....	.....	50	82	90	96	95	96	97	98	94	83	68	43	.....	.....	299.1	353 4	85	49
Cienfuegos, Cuba‡	T.	.....	.....	58	68	73	73	76	80	72	62	56	44	41	44	.....	.....	185.6	292.2	64	60
Havana, Cuba	T.	.....	.....	37	35	42	52	64	69	70	69	61	45	25	26	.....	.....	173.6	334.7	52	40
Kingston, Jamaica, W. I	T.	.....	.....	46	63	85	88	91	83	78	70	68	52	36	39	.....	.....	235.9	344.1	69	58
Port of Spain, Trinidad, W. I	T.	.....	.....	24	37	67	66	71	63	57	60	53	38	19	13	.....	.....	170.1	356.5	48	39
Puerto Principe, Cuba	T.	.....	.....	37	39	62	74	75	73	63	62	57	45	35	32	.....	.....	191.1	338.2	57	54
Roseau, Dominica, W. I	T.	.....	.....	22	22	34	69	82	81	77	77	73	75	59	48	.....	.....	214.5	349.1	61	63
San Juan, Porto Rico	T.	.....	.....	31	41	68	76	81	86	90	87	80	65	39	20	.....	.....	230.3	344.1	67	66
Santiago de Cuba, Cuba	T.	.....	.....	96	93	85	86	83	81	73	69	63	49	42	42	.....	.....	246.5	340.9	72	60
Santo Domingo, Santo Domingo	T.	.....	.....	75	69	76	79	80	85	72	71	70	53	49	52	.....	.....	240.0	344.1	70	66
Willemstad, Curaçao	T.	.....	.....	16	33	58	71	78	82	77	76	74	64	53	42	.....	.....	218.8	355.3	62	49

* Record for 20 days only.

† Record for 25 days only.

‡ Record for 27 days only.

TABLE IX.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during December, 1900, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.												
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	30 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	4-5			1.67														*			
Alpena, Mich.	18			0.14														*			
Atlanta, Ga.	29-30			1.98														0.40			
Atlantic City, N. J.	4			1.30														0.23			
Baltimore, Md.	4			1.50														0.32			
Binghamton, N. Y.	4-5			0.85														0.08			
Bismarck, N. Dak.	1			0.04														*			
Boise, Idaho	16			0.10														0.10			
Boston, Mass.	4-5			1.52														0.23			
Buffalo, N. Y	4-5			0.45														0.06			
Cairo, Ill.	27			1.44														0.25			
Cedar City, Utah				0.00																	
Charleston, S. C.	19-20			1.59														0.26			
Chicago, Ill.	31			0.28														*			
Cincinnati, Ohio	30-31			0.30														0.10			
Cleveland, Ohio	27-28			0.22														0.05			
Columbia, Mo.	6			0.23														0.05			
Columbus, Ohio	7-8			0.36														0.07			
Denver, Colo.	27			0.27														0.04			
Des Moines, Iowa	22-23			0.13														*			
Detroit, Mich.	7			0.20														*			
Dodge, Kans	30			0.05														*			
Duluth, Minn.	23-24			0.26														*			
Eastport, Me.	4-5			1.38														0.15			
Elkins, W. Va	3-4			1.35														0.12			
Erie, Pa.	4-5			0.50														*			
Escanaba, Mich.	23-24			0.67														*			
Evansville, Ind	22			0.83														0.37			
Fort Worth, Tex	12			0.35														0.11			
Fresno, Cal.	17			0.20														*			
Galveston, Tex.	12	9.50 a. m.	3.45 p. m.	2.54	2.00 p. m.	3.00 p. m.	1.05	0.11	0.16	0.26	0.36	0.45	0.52	0.62	0.77	0.97	1.08	1.39	1.46		
Grand Junction, Colo.	21			T.																	
Harrisburg, Pa	4			1.17														0.16			
Hatteras, N. C.	4			1.16														0.49			
Huron, S. Dak.	25			0.04														*			
Indianapolis, Ind.	27-28			0.62														0.20			
Jacksonville, Fla.	28			1.32														0.44			
Jupiter, Fla.	19			0.83														0.47			
Kalispell, Mont	29			0.42														*			
Kansas City, Mo.	6			0.09														*			
Key West, Fla.	1			0.44														0.44			
Knoxville, Tenn	23			0.07														0.28			
Lexington, Ky.	30-31			0.83														0.10			
Lincoln, Nebr.	22			0.43														*			
Little Rock, Ark.	19-20			1.87														0.39			
Los Angeles, Cal.	15			T.																	
Louisville, Ky.	30-31			0.59														0.10			
Macon, Ga.	13-14			2.14														0.45			
Memphis, Tenn.	22			0.54														0.49			
Meridian, Miss.	12-13			1.24														0.23			
Milwaukee, Wis.	31			0.32														0.05			
Montgomery, Ala	19-20			1.43														0.48			
Nantucket, Mass.	4			0.72														0.30			
Nashville, Tenn.	22-23			0.72														0.41			
New Haven, Conn.	4 5			1.34														0.30			
New Orleans, La.	27-28	10.30 p. m.	2.00 p. m.	2.25	12.50 a. m.	1.35 a. m.	0.06	0.08	0.16	0.26	0.46	0.65	0.75	0.84	0.92	0.94	0.97	1.02			
New York, N. Y.	4			1.27														0.32			
Norfolk, Va.	30-31			1.28														0.34			
Northfield, Vt.	4-5			1.01														*			
Oklahoma, Okla.	2-3			1.11														0.35			
Omaha, Nebr.	22-23			0.32														0.04			
Parkersburg, W. Va.	27-28			0.34														0.11			
Philadelphia, Pa.	4			1.52														0.26			
Pittsburg, Pa.	4			1.41														*			
Pocatello, Idaho	20-21			0.50														*			
Portland, Me.	4-5			1.79														0.21			
Portland, Oreg.	19-21			2.02														0.27			
Pueblo, Colo.	30-31			0.37														*			
Raleigh, N. C.	3-4			1.33														0.36			
Richmond, Va.	30-31			0.43														0.19			
Rochester, N. Y.	3-5			1.36														0.14			
St. Louis, Mo.	23			0.13														0.13			
St. Paul, Minn	22-23			0.22														0.11			
Salt Lake City, Utah	29-30			0.16														*			
San Diego, Cal.				0.00																	
Sandusky, Ohio	27-28			0.20														*			
San Francisco, Cal.	16			0.70														0.20			
Savannah, Ga.	29-30			0.98														0.15			
Seattle, Wash.	19-20			2.27														0.39			
Spokane, Wash.	19-20			0.68														*			
Tampa, Fla.	23			1.05														0.50			
Toledo, Ohio	27-28			0.24														*			
Topeka, Kans.	5-6			0.08														*			
Vicksburg, Miss.	19			0.65														0.36			
Washington, D. C.	3-4			1.73														0.30			
Wilmington, N. C.	4			1.64														0.65			
Yankton, S. Dak	22			0.08														*			
Basseterre, St. Kitts	8			0.53														0.24			
Bridgetown, Barbados	9	2.25 a. m.	5.10 a. m.	1.32	2.25 a. m.	3.20 a. m.	0.00	0.12	0.16	0.18	0.27	0.40	0.45	0.46	0.56	0.76	0.91	1.05			
Cienfuegos, Cuba	22			0.27														0.22			
Havana, Cuba	6			0.95														0.50			
Kingston, Jamaica	18-19			0.68														0.23			
Port of Spain, Trin.	11			0.41														0.27			
Puerto Principe, Cuba	21	1.00 a. m.	5.30 a. m.	2.15	1.45 a. m.	3.00 a. m.	0.03	0.06	0.13	0.20	0.29	0.35	0.55	0.87	1.13	1.26	1.36	1.65	1.88	1.99	
Roseau, Dominica	19-20			0.76														0.16			
San Juan, Porto Rico	8			0.39									0.39								
Santiago de Cuba	19			0.22											0.22						
Santo Domingo, S. D.	22	12.30 p. m.	12.55 p. m.	0.68	12.30 p. m.	12.50 p. m.	0.00	0.05	0.21	0.45	0.67	0.68									
Willemstad, Curaçao	17			0.27								0.27									

*Self register not working.

TABLE X.—*Data furnished by the Canadian Meteorological Service, December*, 1900.

Stations.	Pressure.			Temperature.				Precipitation.		
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F.	29.57	29.72	−.13	25.8	− 2.9	31.1	20.4	2.25	−2.83	20.5
Sydney, C. B. I.	29.84	29.88	.00	28.1	− 0.1	33.6	22.6	3.09	−1.63	16.5
Halifax, N. S.	29.84	29.94	−.01	29.0	+ 1.4	36.3	21.7	3.30	−1.99	20.3
Grand Manan, N. B.	29.92	29.97	−.02	27 2	− 1.1	34.2	20.1	3.06	−1.61	19.2
Yarmouth, N. S.	29.90	29.98	.00	31.2	+ 0.5	37.6	24.8	3.51	−1.76	10.6
Charlottet'n, P. E. I.	29.86	29 90	−.02	24.2	− 0.1	30.8	17.5	2.35	−1.65	21.1
Chatham, N. B.	29.90	29.92	−.02	16.1	− 0.9	26.2	6.0	0.59	−2.38	5.9
Father Point, Que.	29.90	29 93	−.03	16 4	+ 1 0	24.2	8.7	1.26	−0.96	12.6
Quebec, Que.	29.66	30.01	.00	15 0	− 0.2	21.6	8.5	1.35	−2.96	11.7
Montreal, Que.	29.81	30.03	.00	18.1	− 0.2	24.1	12.0	2.76	−0.80	25.2
Bissett, Ont.	29.40	30.06	+.03	13.0	− 2.0	21.5	2.4	1.62	−1.12	15.8
Ottawa, Ont.	29.67	30.01	−.02	17.2	+ 0.2	24 6	9.9	1.60	.....	16.0
Kingston, Ont.	29.71	30.04	−.01	25.2	+ 1.5	32.1	18.2	1.39	−2.25	8.1
Toronto, Ont.	29.65	30.05	−.01	29.3	+ 2.3	35.5	23.0	0.83	−1.71	2.2
White River, Ont.	28.56	30.01	−.05	10.4	+ 0.7	21.0	− 0.2	2.04	+0.60	19.4
Port Stanley, Ont	29.40	30.07	+.01	29 0	+ 0.6	35.2	22.7	0.72	−1.89	4.2
Saugeen, Ont.	29.27	30.02	.00	28.2	+ 1.5	34.5	21.9	2.24	−1.89	18.9
Parry Sound, Ont	29.28	30.02	−.01	22.6	+ 1.4	31.4	13.7	3.27	−0.66	24.7
Port Arthur, Ont.	29.27	30.01	−.02	17.2	+ 4.0	26.5	7.9	0.30	−0.55	1.8
Winnipeg, Man.	29.19	30.08	−.03	9.4	+ 5.3	19.7	− 1.0	0 67	−0.52	6.7
Minnedosa, Man.	28.12	30.05	−.06	12.3	+ 6.6	21.5	3.1	0.65	−0.08	6.5
Qu'Appelle, Assin.	27.63	30.02	−.11	14.2	+ 6.8	21.8	6.7	0.34	−0.30	3.4
Medicine Hat, Assin.	27.64	30.00	−.11	31.3	+13.1	41.5	21.1	1.15	+0.79	7.1
Swift Current, Assin.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Calgary, Alberta	26.31	29.94	−.19	27.8	+ 9.6	37.5	18.2	0.10	−0.68	1.0
Banff, Alberta	25.28	30.06	.....	26.1	+ 7.0	32.1	20.1	0.45	−0.80	4.4
Edmonton, Alberta	27.53	29.92	−.09	23.1	+10.0	31.8	14.5	1.25	+0.85	8.5
Prince Albert, Sask.	28.34	29.99	−.10	10.0	+ 7.2	19.1	1.0	1.70	+1.00	17.0
Battleford, Sask.	28.18	30.03	−.07	13.4	+ 8.0	22.5	4.3	0.27	−0.04	2.7
Kamloops, B. C.	28.81	30.12	+.10	37.6	+ 8.7	42.3	33.0	0.56	−0.44	0.0
Victoria, B. C.	29.93	30.03	+.08	45.1	+ 3.8	48.0	42.2	4.07	.....	0.0
Barkerville, N. W. T.	25.53	29.94	.....	27.3	+ 6.4	32.8	21.7	1.60	−2.00	16.0
Hamilton, Bermuda.	29.91	30.07	−.02	64.8	+ 0.1	69.1	60.5	8.21	+3.90	

TABLE XI.—*Heights of rivers referred to zeros of gages, December, 1900.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.[1]	1,954	14	3.6	12	1.8	10,15	2.4	1.8
Reeds Landing, Minn.[2]	1,884	12	1.9	2,3,5-9	0.6	28,29	1.2	1.3
La Crosse, Wis.[3]	1,819	12	5.9	23	3.0	10	4.1	2.9
Prairie du Chien, Wis.[4]	1,759	18	.....	.....	.....	.....	.....	.....
Dubuque, Iowa.[5]	1,699	15	6.3	28	1.8	16,17	3.4	4.5
Leclaire, Iowa.[6]	1,609	10	3.1	1	0.0	18	1.5	3.1
Davenport, Iowa	1,593	15	4.0	1	0.9	18	2.5	3.1
Muscatine, Iowa	1,562	16	5.3	1	1.8	19	3.4	3.5
Galland, Iowa	1,472	8	2.5	1,2	0.6	31	1.5	1.9
Keokuk, Iowa	1,463	15	4.4	1	0.1	29	1.9	4.3
Hannibal, Mo	1,402	13	5.7	1	1.5	30,31	3.1	4.2
Grafton, Ill	1,306	23	8.0	1	3.7	30,31	5.6	4.3
St. Louis, Mo	1,264	30	10.1	1	3.1	30,31	5.8	7.0
Chester, Ill	1,189	35	8.1	1	1.8	31	4.1	6.3
Memphis, Tenn	843	33	24.1	7	5.6	30	14.7	18.5
Helena, Ark	767	42	31.8	8	10.3	31	21.8	21.5
Arkansas City, Ark	635	42	32.4	9,10	13.4	31	24.7	19.0
Greenville, Miss	595	42	27.9	10	10.8	31	21.0	17.1
Vicksburg, Miss	474	45	30.3	12	13.0	31	23.5	17.3
New Orleans, La	108	16	9.8	13	5.0	1	7.7	4.8
Missouri River.								
Bismarck, N. Dak.	1,309	14	3.9	25	2.2	7,8	3.1	1.7
Pierre, S. Dak.[7]	1,114	14	.....	.....	.....	.....	.....	.....
Sioux City, Iowa[8]	784	19	.....	.....	.....	.....	.....	.....
Omaha, Nebr.	669	18	4.5	12	2.6	27,28	3.7	1.9
St. Joseph, Mo.	481	19	0.5	14	— 1.8	29	—0.4	2.3
Kansas City, Mo.	388	21	5.7	11-13	4.2	31	5.3	1.5
Boonville, Mo	199	20	5.4	1	4.7	31	5.0	0.7
Hermann, Mo.	103	24	6.0	1	3.8	25-28	4.5	2.2
Illinois River.								
Peoria, Ill.	135	14	9.7	2,3	8.0	29-31	8.8	1.7
Youghiogheny River.								
Confluence, Pa.	59	10	6.4	5	0.8	26-30	1.9	5.6
West Newton, Pa.	15	23	6.9	5	0.9	19,20,23, 29,30	1.9	6.0
Allegheny River.								
Warren, Pa.	177	14	6.7	1	1.5	26	2.8	5.2
Oil City, Pa	123	13	6.8	1	2.0	25,31	3.2	4.8
Parker, Pa	73	20	7.3	1	1.8	31	3.3	5.5
Monongahela River.								
Weston, W. Va.	161	18	5.8	4	— 0.5	22-28	0.2	6.3
Fairmont, W. Va.	119	25	11.5	5	0.8	22-30	2.2	10.7
Greensboro, Pa.[9]	81	18	14.2	5	7.0	19-29	8.4	7.2
Lock No. 4, Pa.	40	28	18.7	6	6.9	18,19,28,29	8.8	11.8
Conemaugh River.								
Johnstown, Pa.	64	7	5.2	5	1.4	30	2.2	3.8
Red Bank Creek.								
Brookville, Pa	35	8	2.0	1,2,6	1.4	11-31	1.5	0.6
Beaver River.								
Ellwood Junction, Pa.[8]	10	14	3.4	1,7-9	3.1	3-5,27-29	3.2	0.3
Great Kanawha River.								
Charleston, W. Va.	61	30	17.2	6	4.5	17	7.2	12.7
Little Kanawha River.								
Glenville, W. Va.	100	24	8.0	5	— 0.6	27,30	0.9	8.6
New River.								
Hinton, W. Va.	95	14	7.8	5	1.9	28-30	2.9	5.9
Cheat River.								
Rowlesburg, W. Va.	36	14	6.1	5	2.8	2	4.1	3.3
Ohio River.								
Pittsburg, Pa	966	22	13.8	6	2.2	18	5.2	11.6
Davis Island Dam, Pa.	960	25	13.6	6	4.1	18	6.8	9.5
Wheeling, W. Va.	875	36	18.0	7	4.9	20	8.6	13.1
Parkersburg, W. Va.	785	35	20.8	1	5.2	27-30	9.3	15.6
Point Pleasant, W. Va.	703	39	40.1	1	4.1	22	11.0	36.0
Huntington, W. Va.	660	50	34.7	1	7.3	22	15.3	27.4
Catlettsburg, Ky	651	50	35.9	1	5.7	23	14.9	30.2
Portsmouth, Ohio	612	50	37.5	1	7.1	23	16.3	30.4
Cincinnati, Ohio	499	50	40.0	1	7.8	26	19.2	32.2
Madison, Ind.	413	46	34.1	1	8.3	27	17.4	25.8
Louisville, Ky.	367	28	15.4	1	5.0	27,28	8.5	10.4
Evansville, Ind	184	35	33.6	3	6.9	26	18.1	33.7
Paducah, Ky.	47	40	29.8	4	8.0	27	16.8	21.8
Cairo, Ill	1,073	45	32.6	4	11.3	27,28	20.7	21.3
Muskingum River.								
Zanesville, Ohio.	70	30	9.5	1	6.9	25,27,31	7.7	2.6
Scioto River.								
Columbus, Ohio[9]	110	17	3.6	1-5	2.9	19-23	3.2	0.7
Miami River.								
Dayton, Ohio.	69	18	1.9	1	0.8	27	1.3	1.1
Wabash River.								
Mount Carmel, Ill.	50	15	9.1	1	2.7	27-29	4.0	6.4
Licking River.								
Falmouth, Ky.	30	25	5.2	7,31	1.8	28-30	3.5	3.4
Clinch River.								
Speers Ferry, Va	156	20	5.5	5	0.2	20,21	1.0	5.3
Clinton, Tenn.	46	25	12.5	7	4.0	21	6.2	8.5
Tennessee River.								
Knoxville, Tenn.	614	29	6.6	6	1.3	19-21	2.5	5.3
Kingston, Tenn	534	25	6.5	7	1.8	22,23	3.1	4.7
Chattanooga, Tenn.	430	33	9.2	8	3.3	20,21	5.3	5.9
Bridgeport, Ala.	390	24	8.3	1	1.6	22	3.6	6.7
Florence, Ala.	220	16	10.3	1	2.0	20	4.3	8.3
Riverton, Ala.	190	25	14.4	1	2.3	20	5.6	12.1

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
***Tennessee River*—Cont'd.**	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Johnsonville, Tenn.	94	21	15.0	2	3.8	20-22	7.2	11.2
Cumberland River.								
Burnside, Ky.	434	50	8.6	8	2.3	22,23	4.6	6.3
Carthage, Tenn.	257	40	28.4	1	3.0	21-23	6.3	25.4
Nashville, Tenn.	175	40	33.4	1	4.6	23	10.4	28.8
Clarksville, Tenn.[11]	138	42	37.8	1	6.9	22	13.2	30.9
Arkansas River.								
Wichita, Kans.	726	10	1.8	24	1.4	17	1.6	0.4
Webbers Falls, Ind. T.	413	23	4.2	1,3	2.2	30,31	3.0	2.0
Fort Smith, Ark.	351	22	6.4	21,22	3.0	31	4.2	3.4
Dardanelle, Ark.	256	21	7.0	1	2.8	17-19	4.4	4.2
Little Rock, Ark.	176	23	10.0	23	4.5	18	6.7	5.5
White River.								
Newport, Ark.	150	20	16.8	1	3.3	18	6.7	13.5
Yazoo River.								
Yazoo City, Miss.	80	25	12.2	13,14	9.6	1	11.1	2.6
Red River.								
Arthur City, Tex.[10]	688	27	.....	.....	.....	.....	.....	.....
Fulton, Ark.	563	28	14.0	1	5.2	22	7.6	8.8
Shreveport, La	449	29	10.3	1	3.4	24,25	5.6	6.9
Alexandria, La	189	33	8.3	2,3	2.5	27	4.4	5.8
Ouachita River.								
Camden, Ark	340	39	25.0	24	6.2	19	11.8	18.8
Monroe, La	100	40	14.0	7,8,31	5.0	19-21	10.4	9.0
Atchafalaya River.								
Melville, La.	100	31	26.1	15	17.3	1	22.6	8.8
Susquehanna River.								
Wilkesbarre, Pa.	178	14	10.2	29	4.5	25	7.0	5.7
Harrisburg, Pa.	70	17	7.4	7	2.0	21,27	3.8	5.4
W. Br. of Susquehanna.								
Williamsport, Pa.	35	20	7.2	6	1.8	18,24	3.4	5.4
Juniata River.								
Huntingdon, Pa.[12]	80	24	6.6	5	3.0	19-31	3.5	3.6
Potomac River.								
Harpers Ferry, W. Va.	170	16	3.5	7,8	1.5	3	2.5	2.0
James River.								
Lynchburg, Va	257	18	5.8	5	0.7	30	1.7	5.1
Richmond, Va.	110	12	3.8	6	— 1.2	15,16	—0.1	5.0
Roanoke River.								
Weldon, N. C.	90	40	23.2	7	8.2	19,20	9.8	15.0
Cape Fear River.								
Fayetteville, N. C.	100	38	16.0	23	2.1	3	6.0	13.9
Pedee River.								
Cheraw, S. C.	145	27	17.5	6	1.7	19,20	5.0	15.8
Black River.								
Kingstree, S. C.	60	12	7.1	31	1.0	1-4	4.1	6.1
Lynch Creek.								
Effingham, S. C.	35	12	10.0	31	3.8	20	5.9	6.2
Santee River.								
St. Stephens, S. C.	50	12	8.2	31	6.0	22	7.5	2.2
Congaree River.								
Columbia, S. C.	37	15	6.1	5	0.4	29	1.5	5.7
Wateree River.								
Camden, S. C.	45	24	22.1	22	4.0	19	8.7	18.1
Waccamaw River.								
Conway, S. C.	40	7	3.6	31	1.7	5,19	2.5	1.9
Savannah River.								
Calhoun Falls, S. C.	347	.....	3.9	4	2.8	3	3.4	1.1
Augusta, Ga.	208	32	15.2	6	7.6	2	9.6	7.6
Broad River.								
Carlton, Ga.	30	.....	5.0	5	2.4	2,3,17-19	2.9	2.6
Flint River.								
Albany, Ga	80	30	10.3	31	1.8	3	6.5	8.5
Chattahoochee River.								
Westpoint, Ga.	239	20	7.2	31	3.0	19	4.4	4.2
Ocmulgee River.								
Macon, Ga.	125	20	12.8	21	2.5	3	6.0	10.3
Oconee River.								
Dublin, Ga.	60	30	8.4	18,31	1.6	3	5.1	6.8
Coosa River.								
Rome, Ga	225	30	8.0	22	2.0	18,19	4.1	6.0
Gadsden, Ala	144	18	9.0	24	1.5	19	4.8	7.5
Alabama River.								
Montgomery, Ala.	265	35	14.5	24	4.5	13	8.5	10.0
Selma, Ala.	212	35	18.0	26	2.0	13	10.5	16.0
Tombigbee River.								
Columbus, Miss.	303	33	6.8	26	— 1.0	18-21	1.7	7.8
Demopolis, Ala.	155	35	17.9	27	5.0	19	10.4	12.9
Black Warrior River.								
Tuscaloosa, Ala	129	43	18.7	25	5.3	19	9.6	13.4
Brazos River.								
Kopperl, Tex.	369	21	1.2	1-4	0.0	22-31	0.5	1.2
Waco, Tex.	301	22	1.8	17-31	1.2	1	1.6	0.6
Columbia River.								
Umatilla, Oreg	270	25	6.0	24	3.7	1-4	5.3	2.3
The Dalles, Oreg	166	40	10.9	24	5.3	3	7.6	5.6
Willamette River.								
Albany, Oreg	99	20	18.5	23	3.0	9	7.1	15.5
Portland, Oreg	10	15	13.1	24	5.3	11,12	7.6	7.8
Sacramento River.								
Red Bluff, Cal.	241	23	17.6	21	3.1	5-10	6.8	14.5
Sacramento, Cal.	70	29	19.5	27	12.0	13,14	15.2	7.5

[1] Frozen after 24th. [2] Frozen 15th to 17th, inclusive. [3] Frozen 15th to 22d, inclusive. [4] Frozen after 11th. [5] Frozen after 28th. [6] Frozen. [7] Frozen on 16th. [8] Frozen 13th to 25th, inclusive, and 30th and 31st. [9] Frozen 14th to 16th, inclusive. [10] Gage undergoing repairs. [11] Record for 30 days only. [12] Frozen 15th to 18th, inclusive.

XI

Chart I. Tracks of Centers of High Areas. December, 1900.

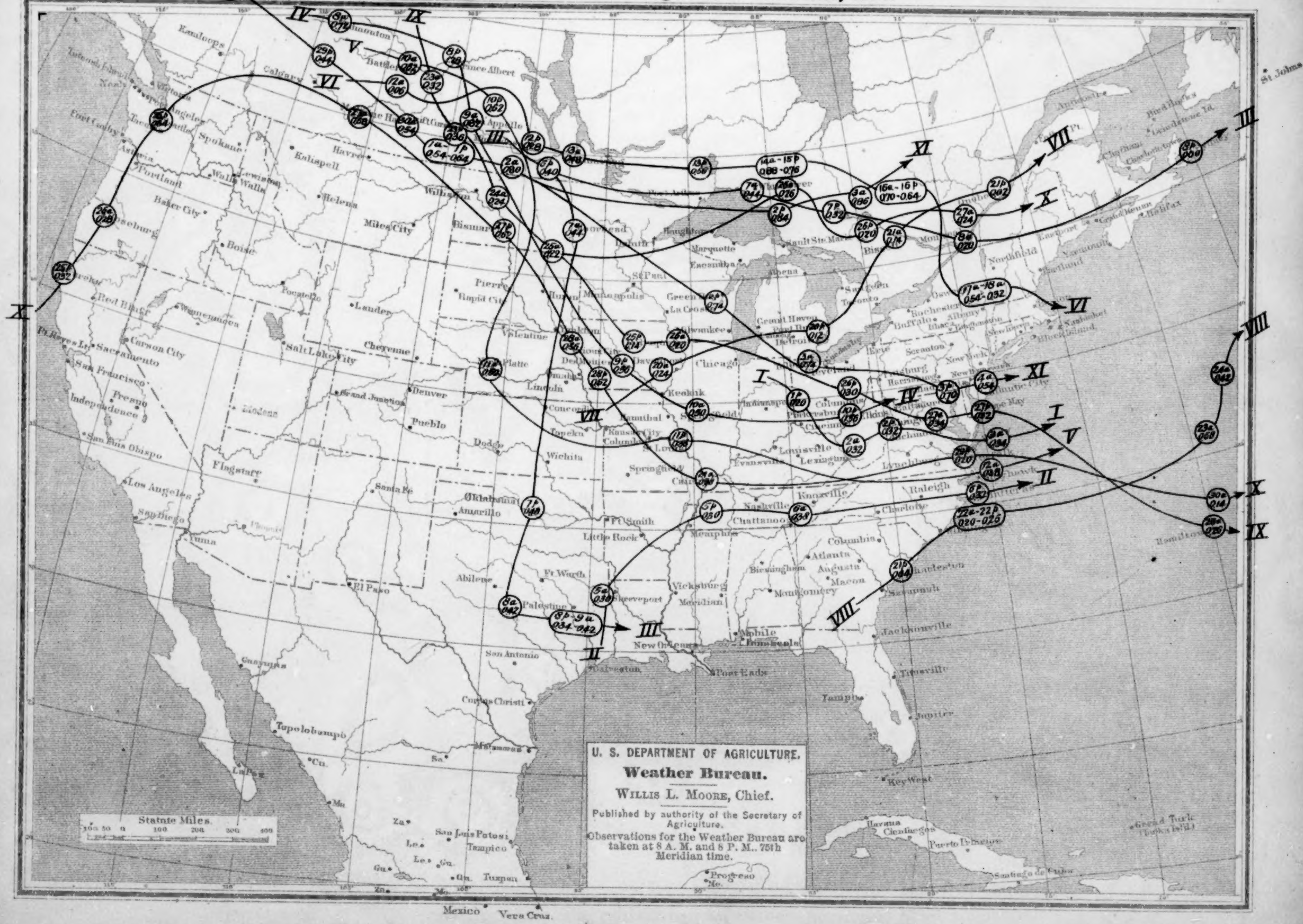


Chart II. Tracks of Centers of Low Areas. December, 1900.

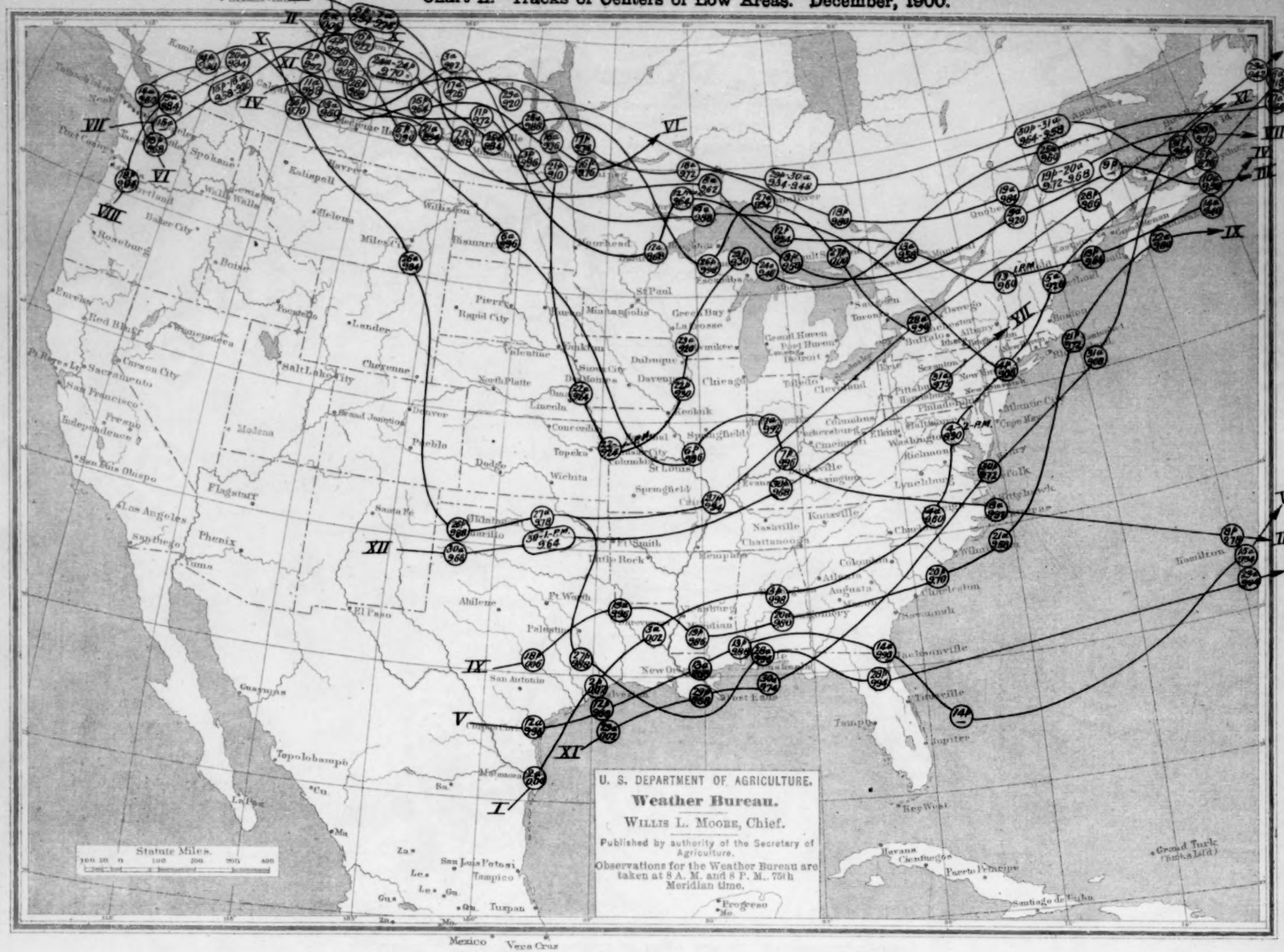


Chart III. Total Precipitation. December, 1900.

Chart III. Total Precipitation. December, 1900.

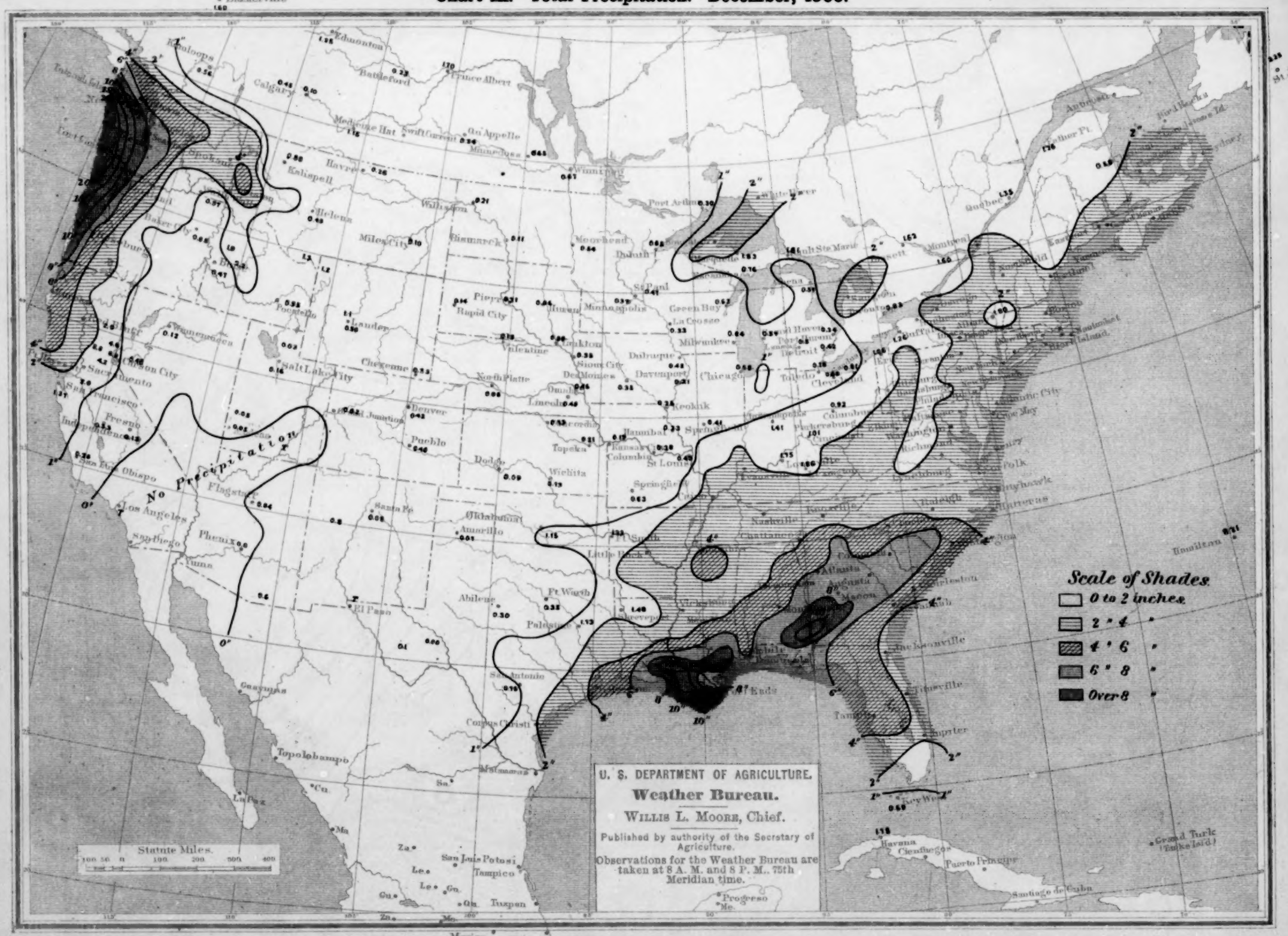

Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
Statute Miles.
100 50 0 100 200 300 400
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
No Precipitation
Bakerville
St Johns
Mexico
Vera Cruz

Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. December, 1900.

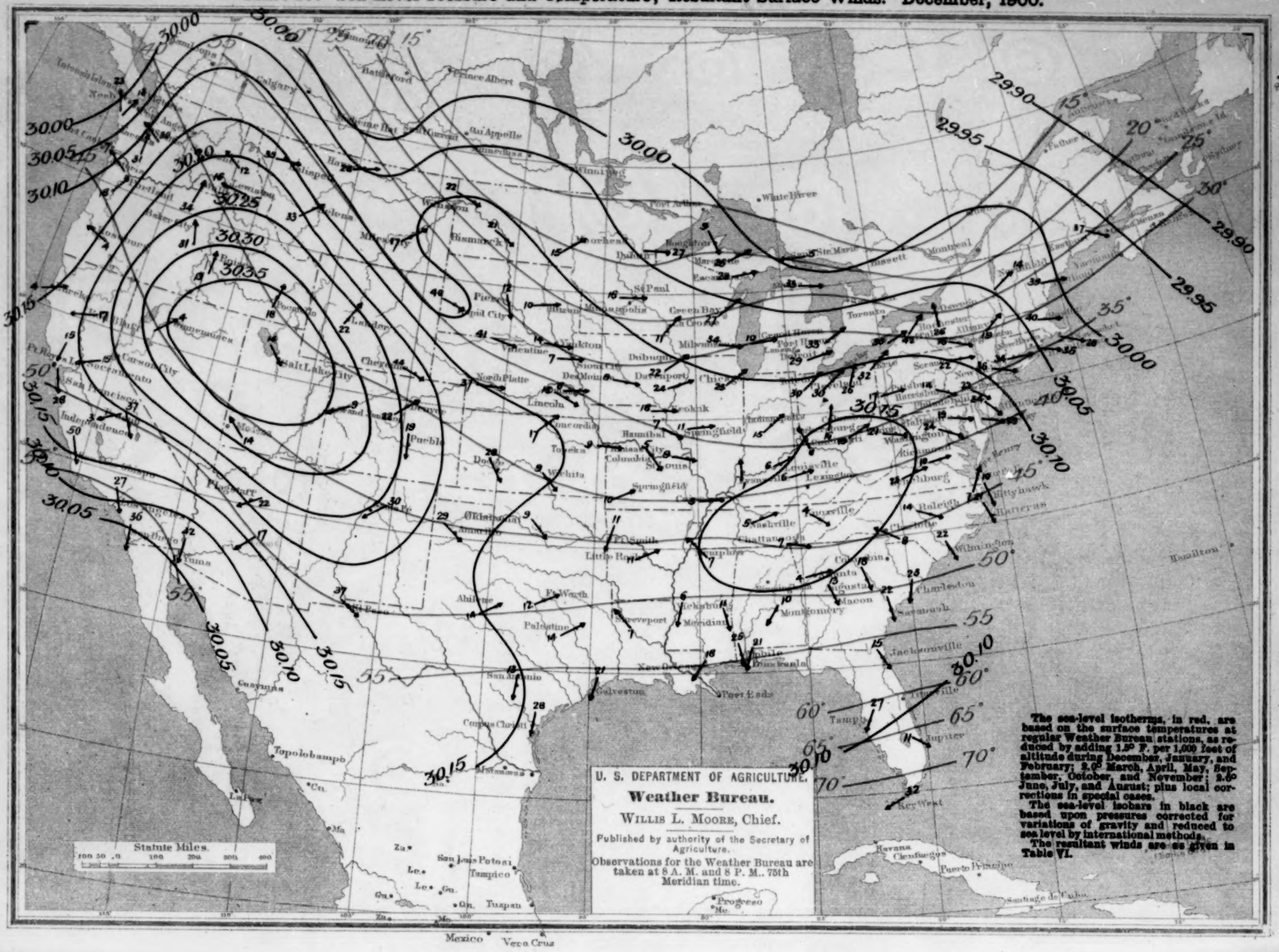
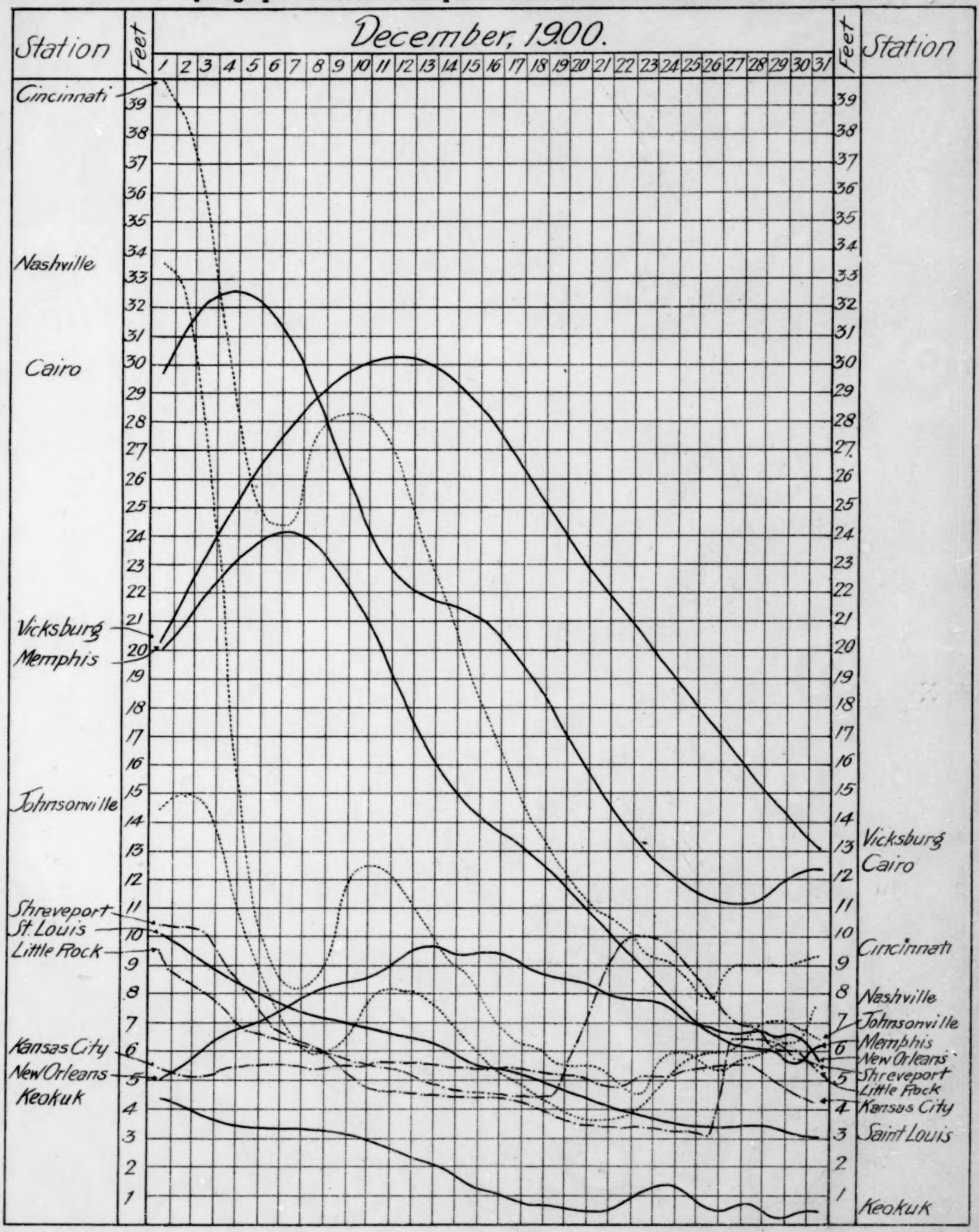
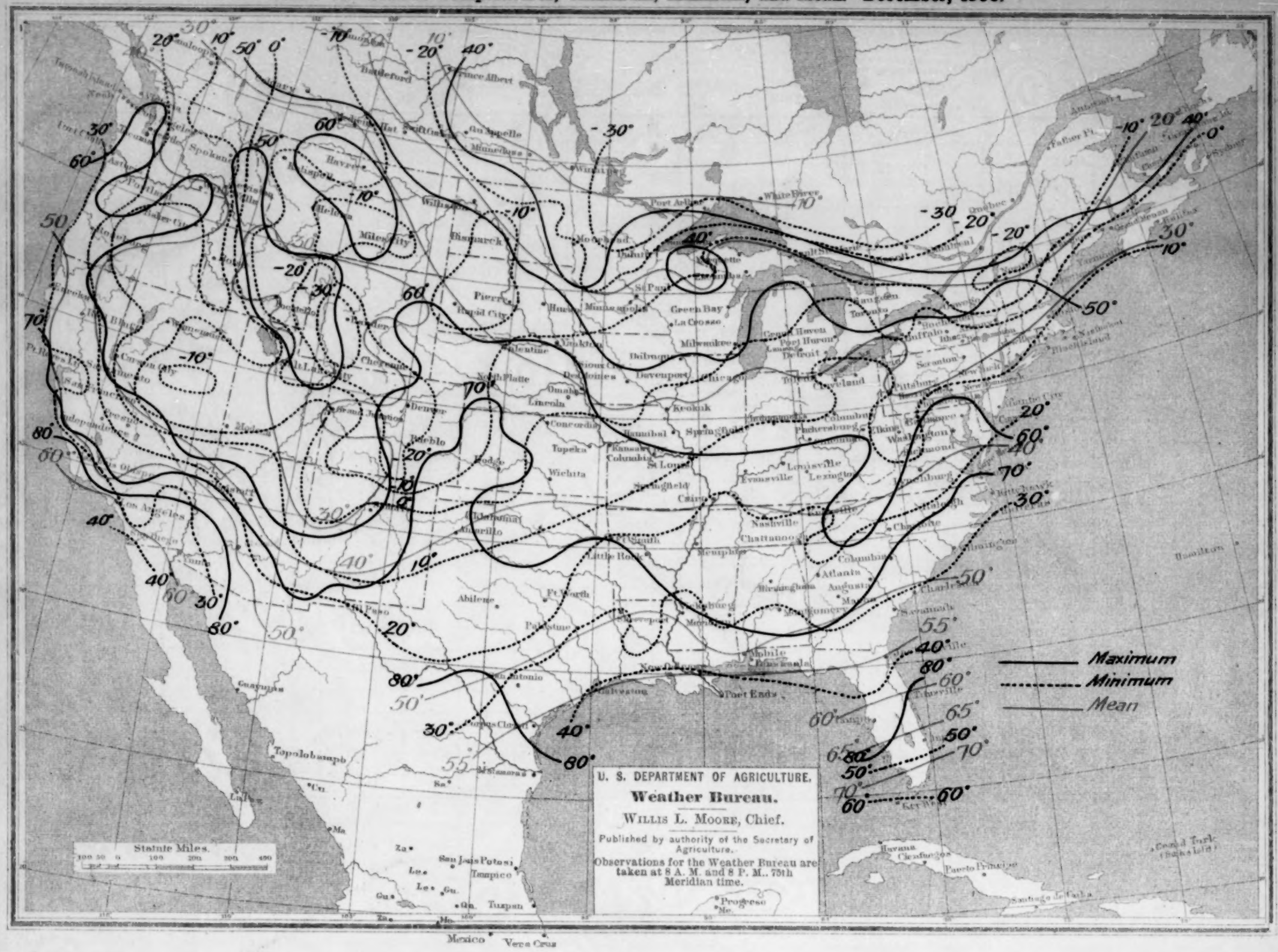


Chart V. Hydrographs for Seven Principal Rivers of the United States. December, 1900.



• Barkerville

Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. December, 1900.



• Barkerville

Chart VII. Percentage of Sunshine. December, 1900.

Chart VII. Percentage of Sunshine. December, 1900.

Scale of Shades.
- Over 50 per cent
- 50 to 40 "
- 40 " 30 "
- 30 " 20 "
- Under 20 "

Statute Miles.
100 50 0 100 200 300 400

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Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

• Baskerville

Chart VIII. Total Snowfall for December, 1900.

Southern limit of Snow
0" and
Statute Miles.
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

• Baskerville

Chart IX. Depth of Snow on Ground December 31, 1900.

Chart IX. Depth of Snow on Ground December 31, 1900.

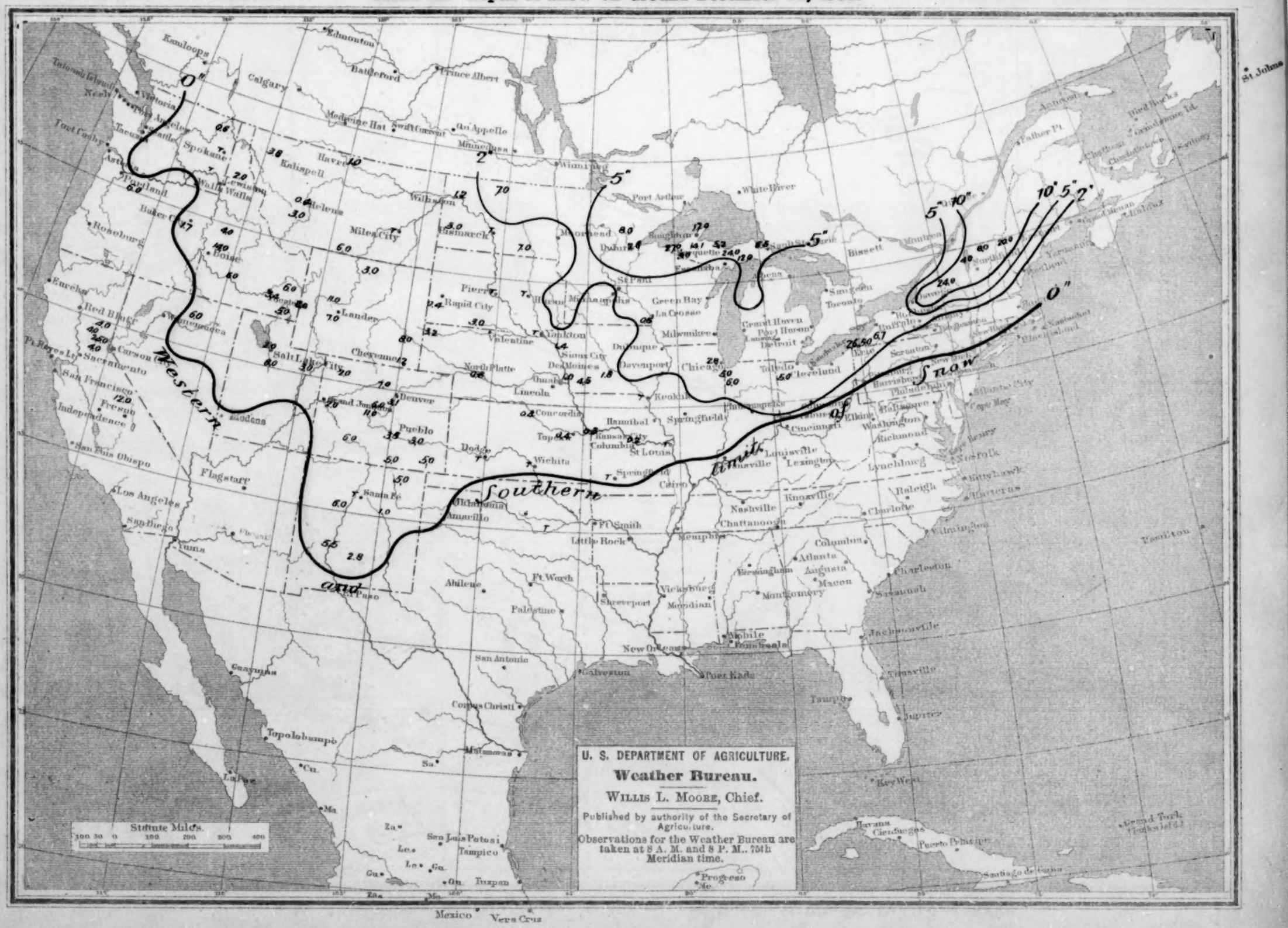

Chart X. West Indian Monthly Isobars, Isotherms, and Resultant Winds. December, 1900.

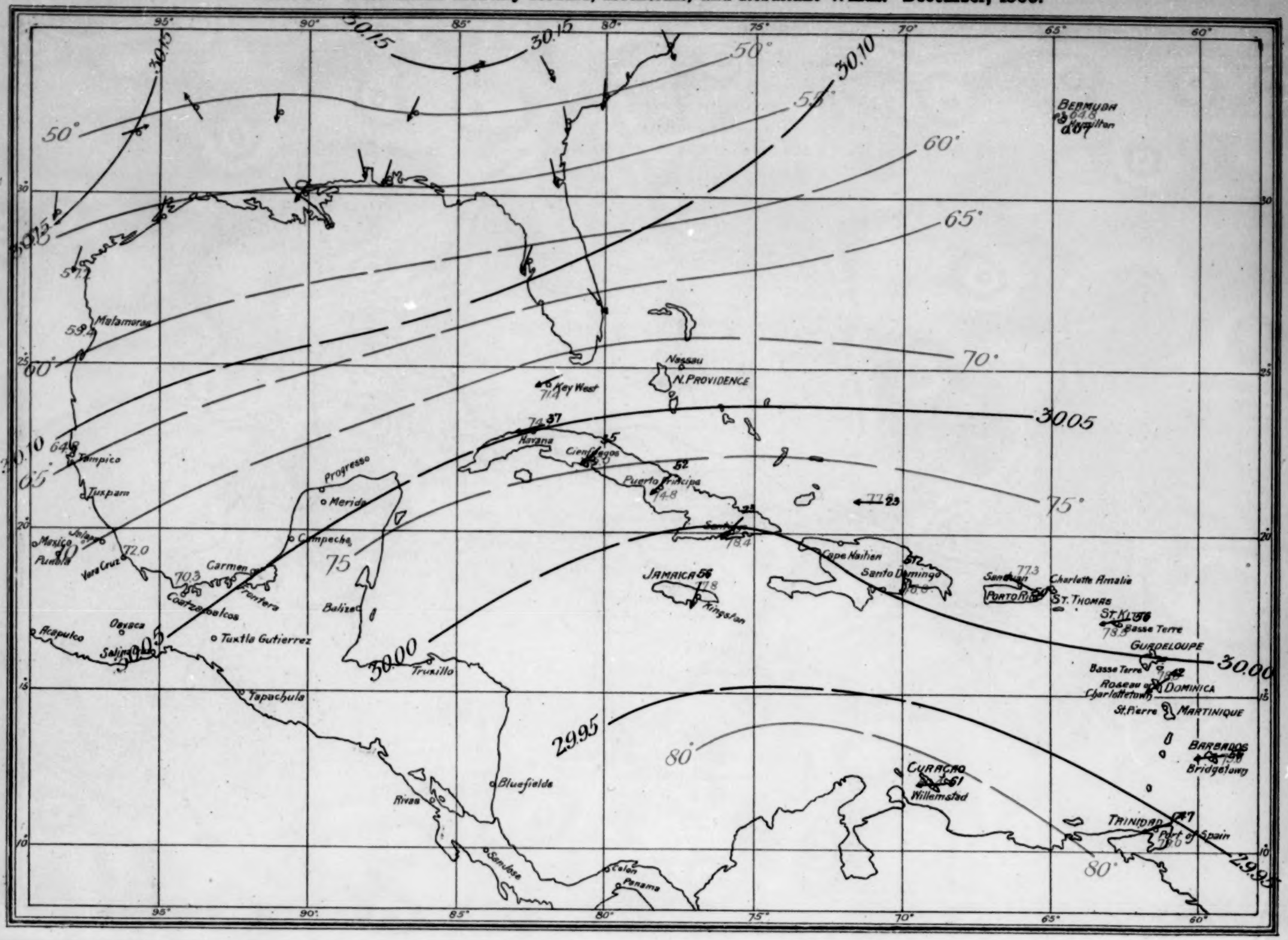

Plate I.—Views illustrating the damage done by storm of November 22, 1900, near Ithaca, N. Y.

FIG. 1.

FIG. 2.